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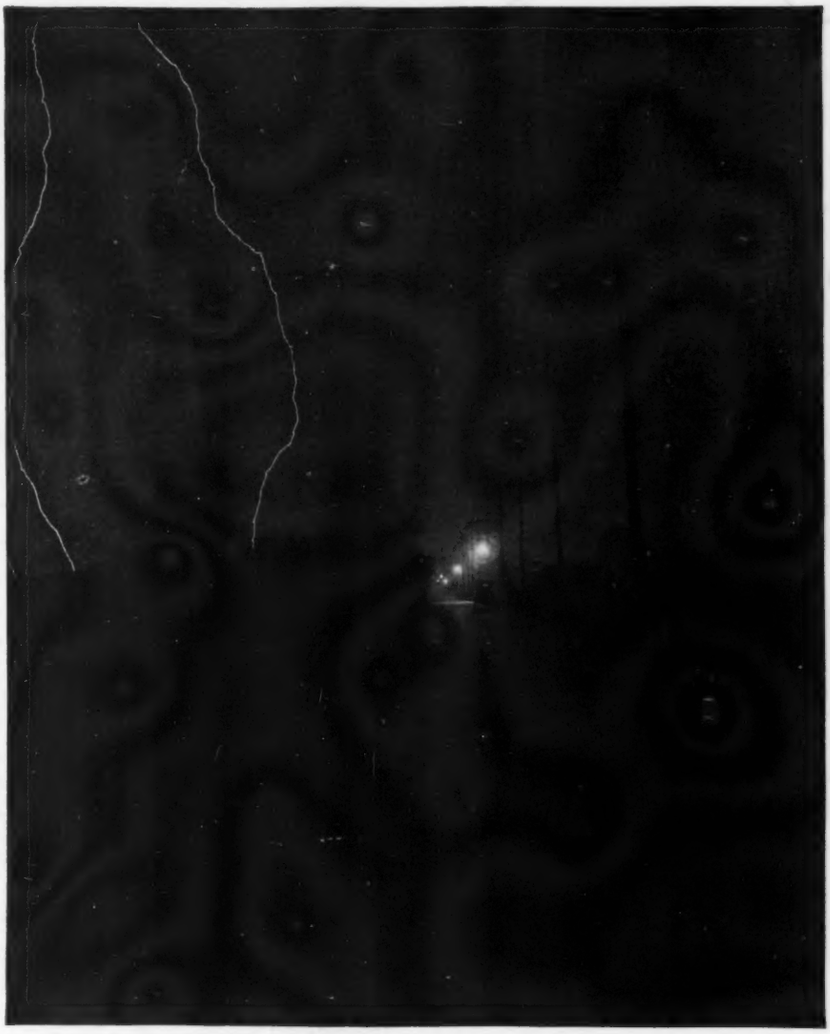
Twenty-five Cents Per Copy

Electrical World

December 8, 1923



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The Outlook for Utilities, ***by Walter H. Johnson***

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Vol. 82, No. 23 New York, December 8, 1923 *Pages 1153-1202*

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Tenth Ave. at 36th St., NEW YORK

WASHINGTON, Colorado Building
CHICAGO, Old Colony Building
PHILADELPHIA, Real Estate Trust Building
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Publishers of
Engineering News-Record — American Machinist
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Ingeniería Internacional
Bus Transportation — Electric Railway Journal
Electrical World — Electrical Merchandising
Journal of Electricity
(*Published in San Francisco*)
Industrial Engineer — Electrical Retailing
(*Published in Chicago*) (*Published in Chicago*)
American Machinist—European Edition
(*Published in London*)

Cable Address "Machinist, N. Y."
The annual subscription rate is $5 in the United States, Canada, Mexico, Alaska, Hawaii, Philippines, Porto Rico, Canal Zone, Honduras, Cuba, Nicaragua, Peru, Colombia, Bolivia, Dominican Republic, Panama, El Salvador, Argentina, Brazil, Spain, Uruguay, Costa Rica, Ecuador, Guatemala, and Paraguay. Extra foreign postage, $4 (total $9 or 38 shillings). Subscriptions may be sent to the New York office or to the London office. Single copies, postage prepaid to any part of the world, 25 cents.
Change of Address — When change of address is ordered the *new* and the *old* address must be given. Notice must be received at least ten days before the change takes place.

Copyright 1923
By McGraw-Hill Company, Inc.

Published weekly
Entered as second-class matter Jan. 29, 1907, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Printed in U. S. A.
Circulation of this issue, 20,250

Member Audit Bureau of Circulations
Member Associated Business Papers, Inc.

A Job for the Industry

A PAPER like the ELECTRICAL WORLD is not just a business enterprise. Primarily it is an industrial institution. As such the editors of the ELECTRICAL WORLD feel a responsibility to serve the industry in many ways that do not appear in the pages of the paper itself. Some vital information is needed by the industry, for instance, that it is nobody else's function to provide. The ELECTRICAL WORLD goes ahead and does the job.

Such a special service may take the form of a survey of power-factor experience, or perhaps of a study to determine who is selling household appliances, presented in a series of articles. Another good example—and something quite apart—is the McGraw Central Station Directory and Data Book, published at the beginning of each year by the directory department of the ELECTRICAL WORLD. This book tells—

The correct name of every electric light and power company in the United States, Canada, Mexico and the West Indies, arranged by states and cities.

Names and addresses of corporation officers and principal department heads, including purchasing agents.

Names of communities and population served.

Names and addresses of holding or controlling companies and list of properties controlled by each.

Financial statistics, such as capital outstanding, common stock, preferred stock, bond issues, etc.

Names and addresses of consulting engineers, if any.

Location of power plants.

Number and make of generators, stating capacity, voltage, whether direct-current or alternating-current, and if alternating-current, phase and cycles.

Voltage of lighting and motor circuits, whether direct-current or alternating-current, and if alternating-current, phase and cycles.

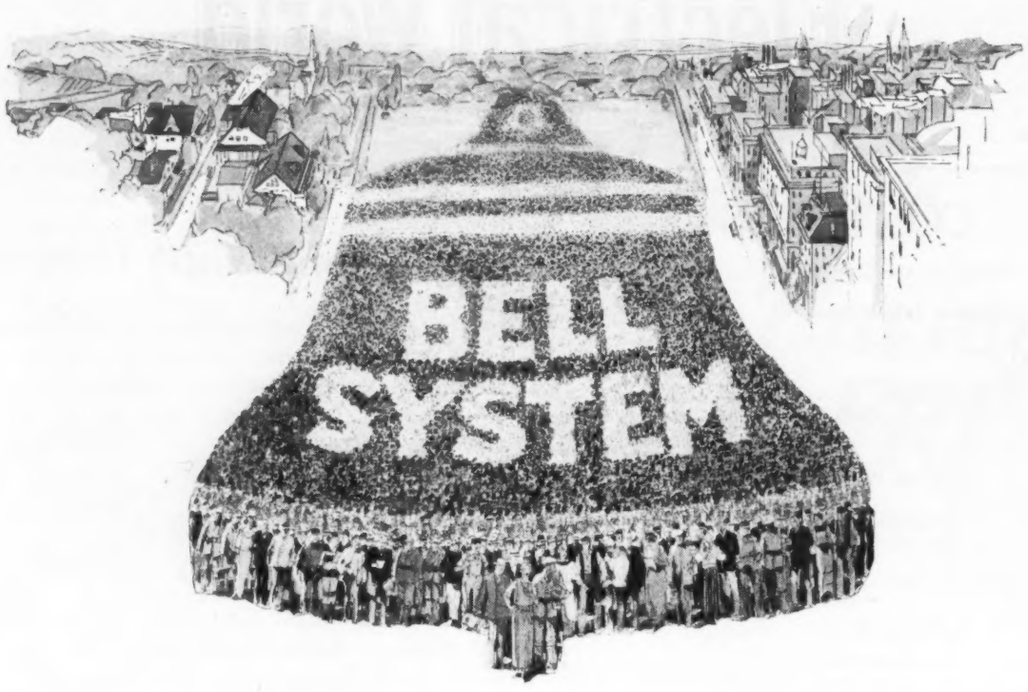
Number of meters.

Total connected power load.

Etc., Etc., Etc., Etc.

The compilation and maintenance of this book involve a tremendous burden of work and responsibility. But the industry needs the information. The ELECTRICAL WORLD feels that it has this opportunity to render an additional service, and so we do the job.

Advertising Index—Alphabetical, 100; Classified 94, 96, 98; Directory of Engineers, 42, 43; Searchlight, 44-45



Giving the Telephone Life

Wherever your thought goes your voice may go. You can talk across the continent as if face to face. Your telephone is the latch to open for you any door in the land.

There is the web of wires. The many switchboards. The maze of apparatus. The millions of telephones. All are parts of a country-wide mechanism for far-speaking. The equipment has cost over 2 billion dollars, but more than equipment is needed.

There must be the guardians of the wires to keep them vital with speech-carrying electrical currents. There must be those who watch the myriads of tiny switchboard lights and answer your commands. There must be technicians of every sort to construct, repair and operate.

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One Policy, One System, Universal Service, and all directed toward Better Service

Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

Volume 82 — New York, Saturday, December 8, 1923 — *Number* 23

Put Our Own Story on the Radio

A REAL opportunity that is being almost entirely ignored lies within reach of electrical men. This opportunity is to broadcast the message of electricity to the two million homes that today are operating radio receiving sets. It is estimated that there is now an unseen audience of several million people who are listening to the radio with considerable regularity. Broadcasting programs are steadily becoming more interesting and more worth while. The popularity of short educational talks is growing. The variety of subjects which are being so presented is expanding all the time. Radio has become one of the accepted mediums for the dissemination of information and knowledge. And yet few electrical men have given it any serious thought.

PUBLIC relations is a live topic with central-station executives today. They are constantly on the alert to discover occasions when the story of electricity may be told to the people. There is no enterprising general manager in the industry who would not jump at the chance of appearing before any large gathering of his consumers and prospective customers to interpret the place of the modern utility in the community. But here nightly waits an audience vaster by far than any single edifice will hold, ready, listening for the words that come so mysteriously into the homes of those who compose it.

Electrical engineers have long wanted more people to know more about what they as a class have contributed to society and to industry. Engineering topics, particularly electrical engineering topics, are especially acceptable to radio audiences. They look to the engineer for authoritative statements as to what can be done and what cannot be done electrically; and engineers owe it to themselves and to their industry to satisfy, in simple yet convincing terms, these thousands of listeners. They are eager to learn more about the many things that electrical engineers can, if they will, tell them.

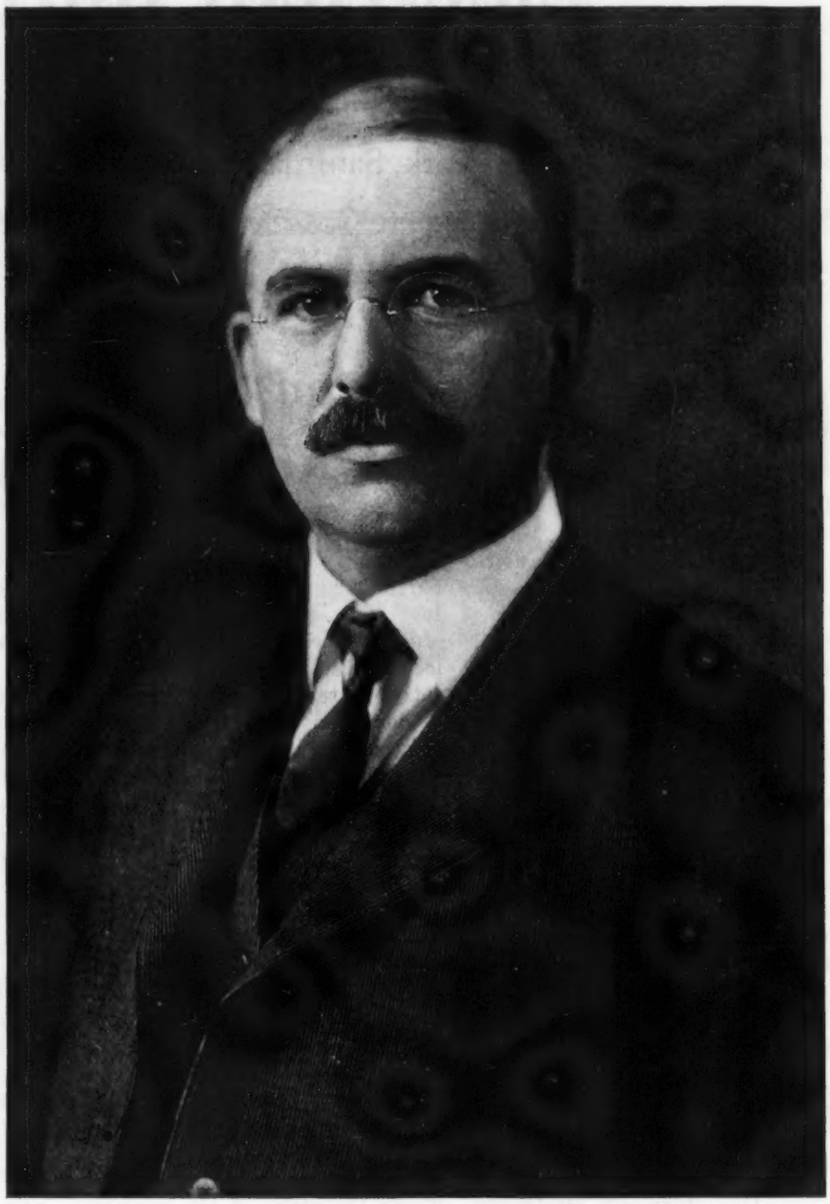
It is time that some organized effort was made to put the story of electricity into "the air." There is a wonderful romance in it that is susceptible to expression in almost endless variety. The story of electricity in industry, in the home, on the farm may be pictured to the popular mind; the story of the generating station, the vision of superpower, the story of the lamp, tales of great electrical men—all these offer appealing themes for radio broadcasting. Some one must take the initiative and get it started.

THREE things will be needed. Electrical men — central-station executives, electrical engineers, manufacturers, jobbers—all must be interested in their personal opportunity to contribute to this great educational program. Next, to some, material must be made available to assist them in preparing their talks—ideas, information, advice, to make it easy for them to do a creditable, useful job. For there are "tricks of the trade" in radio broadcasting to give the best results. Then, finally, some one must arrange the booking with the broadcasting stations so that demand as well as supply shall be assured. And not only will the story of electricity be told, but the very fact of this message being broadcasted will provide an additional service of valuable publicity. For the fact that the general manager of the lighting company or some engineer of prominence is to talk on the radio is news in the community. The bigger the man the wider this news will carry.

THE job is to get such a program started. It is primarily a local problem. No national or central "booking agency" can run the various programs. The local broadcasting station is the place to start, and local electrical men and local leagues should get behind the definite local programs. There is a place, however, for national service by the Society for Electrical Development in this connection. Already it is collecting radio speeches by electrical men, and it can well afford in its efforts to spread the electrical gospel to set up some definite mechanism within its organization to encourage local action—to help see that every listed broadcasting station gives a place to the electrical story. It can also do much by distributing sample addresses and otherwise helping to prepare material for broadcasting.

Reuben James Russell

An electrical manufacturer of single-phase motors who has devoted himself to the cause of standardization and through leadership in association work has achieved much for the electrical industry.



ALMOST every man whose natural ability has won him recognition in any industry and established him in a position of leadership will be found to have had some one strong, direct purpose in his work, some ideal which has inspired him to unusual effort and unusual achievement and attracted to him the attention and the confidence of his fellows. This is signally true in the case of R. J. Russell, president of the Century Electric Company of St. Louis. Early in his career he became convinced of the vital importance of maintaining definite standards in manufacturing production and of strictly adhering to them. In his administration of the Century Electric Company he has proved the practical success of such a policy. In his long service as a leader in the activities of the Electric Power Club he has done his utmost to insure the adoption of this economic principle by the other electrical apparatus manufacturers of America and with noteworthy success.

Mr. Russell was born in Detroit in 1872 and in 1891 entered the employ of the Detroit Electrical Works, manufacturers of electric railway apparatus and general electrical and telephone equipment. Four years later he moved to Cleveland and with the Walker Electric Company devoted himself to the manufacture of electric and cable railway machinery, contributing materially to the progress made in the development of the larger railway apparatus. In 1900 he joined the Wagner Electric & Manufacturing Company, opening its Atlanta office and then being transferred to its general offices in St. Louis, where he remained until 1903, when the Century Electric Company was organized and he became one of its executive officers.

For twelve consecutive years Mr. Russell has been a member of the board of governors of the Electric Power Club, and he has served two terms as its president. He has also been a member of the executive committee of the Electrical Manufacturers' Council. In both these organizations he has persistently endeavored to influence manufacturers to eliminate all non-essential sizes and types and also to anticipate public regulation rather than pursue a policy of yielding only upon public demand.

Mr. Russell believes that American manufacturers should seek a world market, and he has been active in foreign sales. He has steadfastly favored an absolutely open price policy, that prices of all electrical products should be given out to anybody without reservation. These broad principles have had no small influence on American practice during his long activity.

Editorial Comment

Electrical World, December 8, 1923

Volume 82 Number 23

The Stability of Electric Light Securities

DAILY newspapers record the fact that twenty-four country banks closed within six days in the Minneapolis territory, and at least one bank has been reported in the doubtful or uncertain class for every one reported closed. Of the twenty-four closed, one was a national bank and twenty-three were state organizations. Now, by the public, banks are looked upon as the perfection of security, and yet what a contrast they present to electric light and power companies. During the last decade not one strictly electric light and power company has defaulted in its securities, a record unapproached in the entire public utility field; whereas the investment market is strewn with the wrecks of water, gas, telephone, railroad and railway companies innumerable. Moreover, the quality of electric service has been greatly improved during the decade and its actual cost lessened, notwithstanding increased costs of everything going to make up that service. That does not hold for other utility service, and it is a record of which all engaged in the business should be proud. It shows close co-operation and eternal vigilance on the part of the executive, operating and sales branches, and it is only natural that such excellence should be reflected in securities as well.

"We of the South"

NO ONE who visits the new South and gets an impression of the industrial growth of the states below the Mason and Dixon line and east of the Mississippi can fail to receive renewed impressions of the virility and definiteness of purpose of that development. To an electrical man particularly this expansion has special significance, since the future of this well-started development is intimately linked with the electrical industry. It is perhaps not too much to say that what slave power was to the old South from an economic point of view hydro-electric power is to this new country.

The achievements in this undeveloped territory are noticeable not alone for specific engineering accomplishment nor in the actual statistics of growth, but in the "will to do" which is everywhere expressed by industrial and electrical men. The South is leading in certain specific engineering accomplishments, such as the practical working out of an effective tie-in between power plants and the actual accomplishment of the superpower idea. From an engineering viewpoint, moreover, certain of the hydro-electric developments are epoch-making. The figures for actual growth of industries in North Carolina, Alabama and Georgia also are tangible evidences of the new order. But greater than all these is the long-sighted industrial statesmanship which is being exhibited by electrical men and by the utility commissioners and which may well be emulated in every state. One who attended the recent meeting of the Southeastern Section of the National Electric Light Association at Tampa and heard the speeches by Commissioner Maxwell of North Carolina and Commissioner Burr of Florida recognized that he was listening to state regulation expressed in terms of fundamental economic needs. These speeches, together with the plans expressed there by leaders of the industry for definite industrial betterment programs and the application of electricity to the development of agriculture, were not only specific in their recommendations but had that quality of looking ahead for the industry which spells true progress.

Applications of electricity in the fields of industrial heating, industrial power, the electric truck, were discussed at this meeting in terms of actual accomplishment. One of the outstanding features of the new industrial development is the extension of the use of electricity on the farm. A practical start has been made in this at the Alabama Polytechnic Institute with the co-operation of the Alabama Power Company, in which the application of electricity is being analyzed, not alone from the viewpoint of furnishing electricity to the farmer, but in the spirit of helping the farmer find diversified applications for power which will reduce his costs of operation, under the guidance of a farm expert and agricultural engineer.

The South has many problems in this new development. Costs of transmission are relatively more important than primary generating costs. Industrial communities in the South are pearls on long strings, and one gets an impression of distances between cities which parallel the conditions in the Far Western States. The South needs capital to meet the growing demands for power. It is looking for ideas from the North on intensive commercial development, but the impression lingers that these problems are, in homely illustration, the problems of clothing a rapidly growing youth. Electrical development represents the essential trousers, which must be kept long enough. No one from outside its own area can visit the new South without being conscious of wanting to say, "We of the South," and not "You of the South," in helping its electrical industry reach its ultimate destiny.

The Engineer as a Public Servant

MANY times in the past few years has a high light been thrown on the engineer and his opportunity, his obligation, to be of service in a public way aside from his purely technical work. While much of this agitation—and it has been constructive agitation—has had its source in the consciousness of the engineer himself, yet some of it has also emanated from others who see in the engineer some one whose capabilities should be utilized for the general social good.

The subject was again called forcibly to attention

this week in the presidential address at the annual meeting of the American Society of Mechanical Engineers. As was the case with President D. S. Kimball last year, so this year President J. L. Harrington finds this subject the most important one to place before the members of the society. Two points were made this year: that it is up to the engineer to solve the industrial problem —to keep the native American in industry; and that the engineer must make himself a definite factor in political development, now retarded by the hordes of lawyers with their precedents.

These fields are strange to the technical engineer. His own work in the development of engineering industries has thus far completely engrossed him. Now, having brought them to such a stage that they affect and are a part of the lives of every one, he finds that he must orient himself in order best to understand the next work of applying his methods to the solution of the more general problems of the day, problems largely a result of engineering accomplishment.

But the engineer is meeting the challenge to his ability. He realizes that he has a duty to his fellows in the way of public service as well as technical service, and he is starting to perform. And the opportunity for the electrical engineer today transcends that of any other. It is he who has the advantage of most intimately serving by labor-saving accomplishments. It is to the electrical engineer that the country looks for greater development of natural resources. He has made living easier. He has connected every one by electrical communication. His is the most human of the various engineering services. It is for these reasons that the electrical engineer has a special opportunity—he has a good will already created—to have a useful influence with his fellowmen in public service, and the opportunity must not be allowed to pass.

Teach Political Responsibility in the Colleges

ENGINEERS are generally sound in their citizenship but inactive in assuming any political responsibility. They are trained to have a sense of responsibility, of thorough performance and of discipline in their professional environment, but, in general, they exercise too lightly and too carelessly the political leadership their knowledge entitles them to assume.

They are inclined to laugh at the political fallacies of most reformers and not to serve as true leaders in opening the gates to larger fields of national prosperity and well being. The rank and file are like the average college student who successfully carries on his studies but takes no part in the extra-curriculum activities.

In the opinion of many, the most fruitful field of endeavor lies in attempting to educate the thousands of young engineers in the colleges. Without detriment to their technical proficiency, these young men could be taught to appreciate their personal responsibility of participating in national affairs. But the leaders of industry must give impetus and direction to this type of education. They only have the data, the perspective and the fresh contact with affairs whereby the young engineers can be taught to be conscious of their obligations to the nation. Splendid possibilities are afforded the national engineering associations to make this a definite and constructive part of their program of activity, and it is encouraging to note that the educators are cordially receptive to any plans that may be proposed to accomplish such desirable results.

Higher Voltage the Only Answer to the Distribution Problem

THE growth in load densities, the extension of electrical systems and the increased investment in copper involved in these changes have resulted in very detailed studies of distribution systems for metropolitan areas. To the old debate about the relative merits of direct current and alternating current, two-phase, three-phase and three-phase four-wire, have been added debates about the most economical voltage or voltages to use in view of the ultimate growth in system loads.

While charts of relative copper economics and theoretical studies of high-voltage system economics have been available for years, little has been done to determine upon any modification to adopt as a type of system to build. There are so many variables in the equation that it is almost impossible to obtain an exact solution even under the pressure of commercial necessity. Legal limitations, safety limitations, cable and equipment limitations, indefinite estimates of future requirements and a lack of real engineering and economic data are handicaps that face each property in a different aspect.

In the past few years the pressure for better "economic engineering" in electrical distribution has caused many two-phase systems to change to three-phase and many three-phase three-wire systems to change to three-phase four-wire. But, apparently, these changes are merely stop gaps in the development that must occur if the investment in distribution circuits is to be reduced and service reliability increased.

Two outlets are recognized as available for bettering the situation—raising the voltage and multiplying the phases—and of the two only the first seems to offer any concrete hope. It is apparent that 115 volts and 230 volts will remain standard for service voltages, although it may be that the future will see the elimination of the 115-volt secondaries. Studies show that 2,300-volt primary distribution is uneconomical, while even the 4,000-volt, four-wire system, though it helps some, is not the answer. Above these voltages systems are being tried out at 6,600, 11,000, 13,200, 22,000, 66,000 and 132,000 volts for the main primary lines. Which is the most economical and best to use in this wide range of voltages is as yet undetermined, and the decision is very materially affected by the specific system considered. From an engineering standpoint, as regards the development of equipment, there are no limitations to the use of the highest voltage on overhead systems, and only the unreliability of high-voltage underground cables prevents the same condition in the underground system. But, aside from the technical aspects, there are economic, social and legal phases which give great trouble to those studying the problem. Costs can pretty well be figured, and on this basis the higher voltage would be decided upon, even though each 66,000-volt, 30,000-kva. substation of the outdoor type involves an expenditure of more than $800,000 when any number of feeders are to be supplied. But the cost of rights-of-way, lines and equipment is difficult to determine exactly when only a seer can vision the possibility of these voltages being permitted on city streets in overhead-line installations. Not even the utility executives agree as to the feasibility of these voltages on overhead systems in populous districts, and much comment is caused by the daring of one company in using 13,000-volt overhead distribution in outlying areas of a large city.

Custom, habit and the type of development undergone by distribution systems work against the adoption of higher distribution voltages even when careful analysis shows that these lines when properly installed are safe, economical and reliable. And yet the financial pressure is getting increasingly stronger and the demands for service increasingly greater, so that a decision about the distribution systems must soon be made, even though every bit of evidence indicates that only the use of very high voltages will adequately solve the economic and engineering problem.

Study, trial and education which begins at home are methods to use to get the answer, but every lead seems to end at the initial theorem, that distribution of electrical energy must occur at voltages very much higher than those used at present on any property. To this may be added as a corollary that any property that takes a half-way step in raising its distribution voltage is wasting good money.

Resistance of Ground Returns

ENGINEERS are accustomed to think of the electrical resistance of earth paths as being of widely varying magnitude dependent upon local conditions. This idea is entirely natural in view of numerous tests which have been made of the voltage necessary to pass current through the earth between electrodes of varying degrees of size and separation. The values of resistance so obtained, while variable, are usually quite high, indicating that as a portion of a circuit for the transmission of energy the earth can have but little value. On the other hand, the troubles which have arisen from electrolysis in structures near the track return of electric railroad systems show that the earth currents may have considerable value. In these cases, however, neighboring underground metallic systems are largely contributory, and even these conspicuous cases of earth return do not necessarily indicate low values of earth resistance.

The value of the resistivity of the earth over long distances is a question of some importance in connection with a mutual impedance between power, telegraph and telephone lines. This mutual impedance obviously has an important bearing on the question of inductive interference. In these cases, however, the length of the ground return is very much greater than has been usual in the power field and in measurements such as those referred to above; moreover, the values of current are very much smaller. An interesting theoretical analysis of the values of mutual resistance and inductance between long circuits grounded to the earth has been made by George A. Campbell and published in the October number of the *Bell System Technical Journal*. This study has been made in the assumption of a constant value for the resistivity of the earth, and it concerns itself with different values of the elevation of the lines and the distances between conductors. The theoretical analysis has been checked by a series of experiments on a number of lines of different lengths, and the results of observation are in general agreement with the theoretical analysis and indicate a value of the resistivity of the earth approximately constant at 0.5 megohm per centimeter cube. It is apparent from these results that, if taken over a considerable length of line, it may be assumed that the earth has a constant value of resistivity. The investigation referred to confines itself to the direct-current case, and due account of penetration into the surface of the earth is taken. A study of the alternating case is promised, with particular reference to the screening effect of the earth in limiting the current to layers near the surface.

The "Danger of Over-lighting"

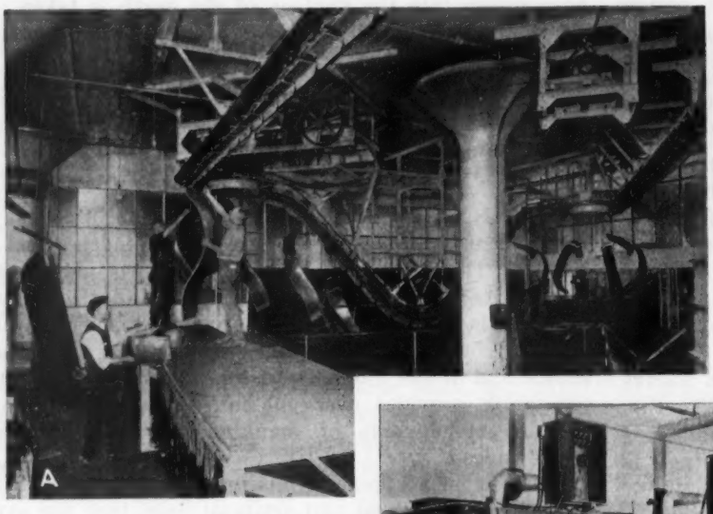
IN MANY respects the aim of human progress is either to improve upon or to become independent of nature. The harnessing of electricity has aided mankind in its efforts to realize this aim. Indoors, electric lighting is often a great improvement over natural lighting, but when one thinks of the sun as a light source and of the intensity of the illumination which it constantly provides over one-half the earth's surface, the accomplishments of mankind in this field seem feeble indeed.

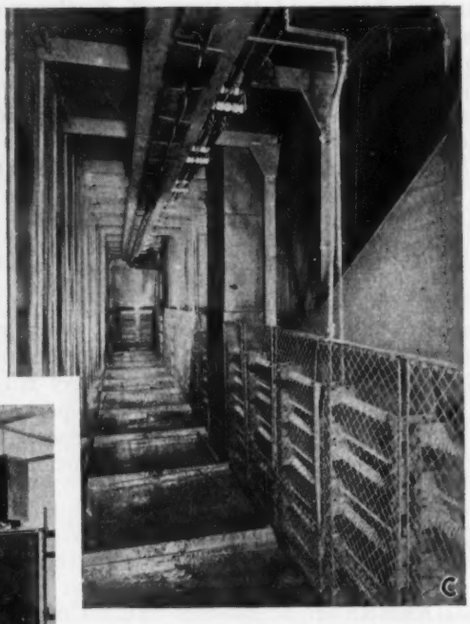
There is such a general misconception of the relative intensities of natural and artificial light that the overwhelming intensity of sunlight compared with ordinary manufactured lighting intensities cannot be overemphasized. One often hears the expression "Too much light" in connection with an artificial lighting installation when, of course, "Too much glare" would probably describe the condition accurately.

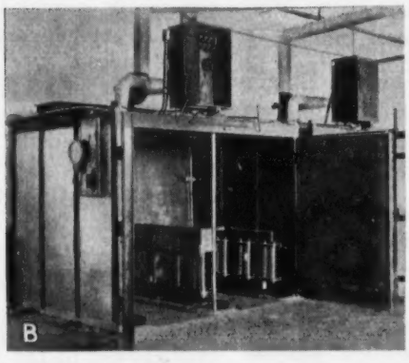
On a clear June day at noon outdoors the earth is illuminated to an intensity of 10,000 foot-candles. The candlepower of the sun is so great that all the artificial light made by mankind dwindles to an insignificant spark by comparison. This candlepower as determined by the foot-candles at the earth's surface, from the sun at its known distance, is about 25×10^{20}. Actually it is much greater owing to the absorption of the earth's and the sun's atmospheres. No adequate conception of this luminous intensity can be obtained from the bare figure. Possibly it would help to put it in terms of the earth's population of about two billion beings. If all the inhabitants of the earth were gathered into one group and if to each person there were given a billion lamps of a billion candlepower each, there would be an aggregate light source which would compete with the sun in luminous intensity. Looked at from another angle, if the present rate of manufacture of light sources were increased a billion times, it would still require a hundred million years to accumulate enough lamps for their combined candlepower to compete with that of the sun.

But let the great distance of the sun be eliminated from the computations and consider illuminating the earth from a reasonable earthly distance by means of lamps contained in perfect reflectors. Suppose the population of the earth to be distributed uniformly over its surface. Each person would occupy about a 500-foot square. If present-day 1,000-watt lamps were used and all the light were reflected toward the earth, each 500-foot square would require more than one million such lamps. In other words, each person on the average would have to manufacture one million 1,000-watt lamps every thousand hours or every forty days, or 25,000 lamps each day. These same people would also have to mine the coal and do all the incidental things that the central-station company does to supply the electrical energy to operate the lamps.

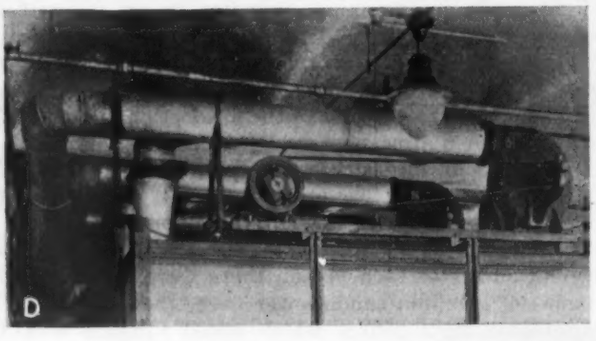
It may seem foolish to compile such figures. But at least they may startle us into a realization that there is no danger of overlighting this earth by the feeble facilities of mankind at the present time. Such danger dwindles to less than a suspicion of a ghost of a reality.

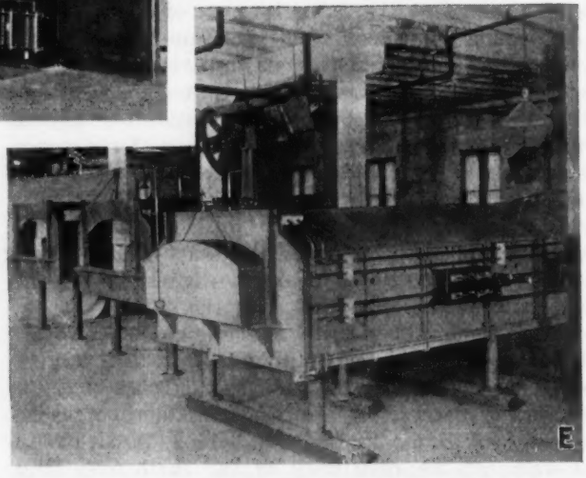






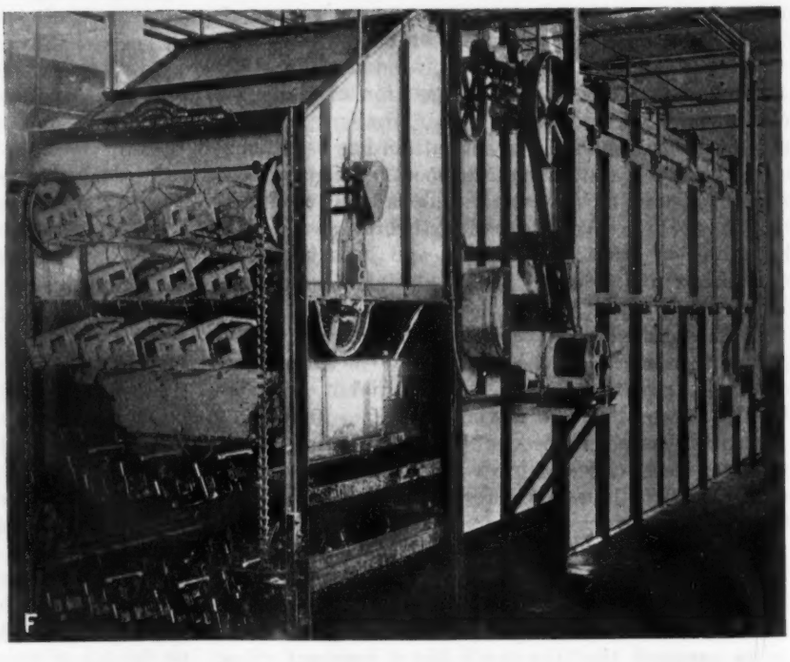
Electric Heat Reduces Labor Cost and Eliminates Waste





IN INDUSTRY electricity has rapidly forged to the front because of its adaptability to manufacturing requirements. In handling materials, heat applications, processes and other phases of activity electrical energy can be applied economically and at the same time efficiently.

In the automobile industry electric ovens and conveyors handle many large parts very efficiently, as is indicated in A and C. For japanning and enameling there is available a truck type furnace (B) or continuous conveyor types (F) which enamel or japan many small parts. Ventilation is readily applied by using motor-driven fans (D), and for heat-treating tools and other work requiring higher temperatures furnaces of the type shown in (E) have found a widespread use.



Line and Substation Costs*

Comparison of Costs of 66-Kv., 110-Kv. and 132-Kv. Lines and Substations—Recommended Construction of Substations and Lines—Detailed Unit Costs and Discussion of Overhead Costs

THE work of preparing cost estimates of transmission lines and substations for operation at 66 kv., 110 kv. and 132 kv. involved the compilation of unit prices as of May 1, 1923, the study of costs of right-of-way and other variables depending upon line location, and the determination of the design and type of construction to be used in lines and substations. The result, while it is an estimate, affords a basis for working out specific cost problems and serves to give illustrative figures for checking up specific studies made by others. A summary of costs is shown in Table I.

TABLE I—SUMMARY OF COSTS OF LINES AND SUBSTATIONS

Voltage	Cost of Line per Mile	Cost of 6,000-Kva. Tap Substation	Cost of 15,000-Kva. Sectionalizing Substation
66,000	$18,031	$103,662	$184,253
110,000	18,559	140,145	242,773
132,000	20,362	179,346	299,506

The construction covered is typical of that to be employed in connecting moderately large power centers in a reliable manner. It is not implied that other forms of construction may not be employed to advantage in particular cases. For example, the use of flexible steel or wooden transmission structures may be very well justified under certain conditions. In the time at its disposal the sub-committee was unable to make estimates covering all the possible combinations of materials, but estimates have been so itemized that the difference in cost caused by changes in the type of construction can be readily calculated.

The prices of materials used are those at which the various items could be purchased on May 1, 1923. Unit costs have been given, where practicable, so that the estimates can be brought up to date at any time. Labor costs are the average of the estimates and actual costs of a number of companies which have recently carried on similar construction in New York and neighboring states.

*Abstract from report of transmission lines committee, presented before convention of Empire State Gas and Electric Association, Lake Placid, N. Y., Oct. 8-9, 1923.

Transmission Line Costs

Right-of-Way.—It was assumed that for permanent construction the cost of a strip of land, purchased outright, would be but little greater than that for tower easements. The 100-ft. strip included in the estimate provides space for additional construction in the future.

Structures.—For the estimates four-legged steel towers carrying two circuits were selected as line supports at all voltages. The same structures are used for the 66-kv. and the 110-kv. line, as it was considered that in any construction of this sort designed to operate at 66 kv. at present the clearances should be large enough to allow the voltage to be raised to 110 kv. Conductor spacing for 66 kv. and 110 kv. is 10 ft. vertical, 20 ft. horizontal, with middle conductor offset 2 ft. on each side of tower. For 132 kv. the spacing is 13 ft. verti-

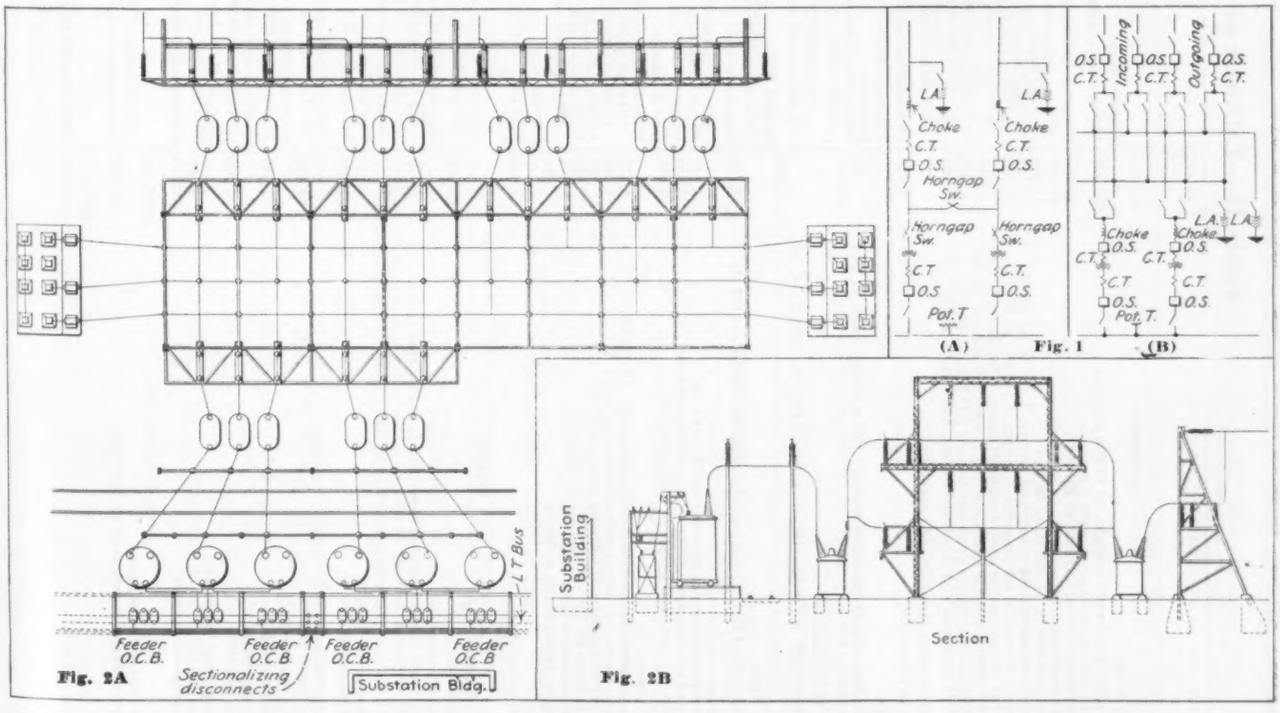


FIG. 1—SINGLE-LINE DIAGRAMS OF SUBSTATIONS: (A) TAP SUBSTATION; (B) SECTIONALIZING SUBSTATION.
FIG. 2—(A) PLAN OF 110,000-VOLT SECTIONALIZING SUBSTATION; (B) SECTION OF 110,000-VOLT SECTIONALIZING SUBSTATION

Table II—Estimate of Cost of Three-Phase, Double-Circuit 30-Mile Line

66 KV.*		110 KV.		132 KV.	
Material		**Material**		**Material**	
Right-of-Way:		*Right-of-Way:*		*Right-of-Way:*	
100 ft. strip, purchased outright, at $3,000 per mile	$90,000	100 ft. strip, purchased outright, at $3,000 per mile	$90,000	100 ft. strip, purchased outright, at $3,000 per mile	$90,000
Supports: (galvanized-steel towers, 8 per mile)		*Supports* (galvanized-steel towers, 8 per mile):		*Supports* (galvanized-steel towers, 8 per mile):	
190 suspension towers, 7,250 lb., at $0.065	89,500	190 suspension towers, 7,250 lb., at $0.065	89,500	190 suspension towers, 9,000 lb., at $0.065	111,200
32 semi-dead-end towers, 10,375 lb., at $0.065	21,590	32 semi dead-end towers, 10,375 lb., at $0.065	21,590	32 semi-dead-end towers, 12,800 lb., at $0.065	26,620
18 dead-end towers, 12,700 lb. at $0.065	14,860	18 dead-end towers, 12,700 lb., at $0.065	14,860	18 dead-end towers, 15,160 lb., at $0.065	17,740
18 10-ft. extensions for suspension towers, 1,170 lb. at $0.065	1,370	18 10-ft. extensions for suspension towers, 1,170 lb., at $0.065	1,370	18 10-ft. extensions for suspension towers, 1,450 lb., at $0.065	1,697
9 20-ft. extensions for suspension towers, 2,180 lb., at $0.065	1,275	9 20-ft. extensions for suspension towers, 2,180 lb., at $0.065	1,275	9 20-ft. extensions for suspension towers, 2,710 lb., at $0.065	1,585
5 10-ft. extensions for semi-dead-end towers, 1,760 lb., at $0.065	572	5 10-ft. extensions for semi-dead-end towers, 1,760 lb., at $0.065	572	5 10-ft. extensions for semi-dead-end towers, 2,180 lb., at $0.065	708
3 20 ft. extensions for semi-dead-end towers, 3,050 lb., at $0.065	595	3 20-ft. extensions for semi-dead-end towers, 3,050 lb., at $0.065	595	3 20-ft. extensions for semi-dead-end towers, 3,760 lb., at $0.065	733
3 10-ft. extensions for dead-end towers, 2,250 lb., at $0.065	439	3 10-ft. extensions for dead-end towers, 2,250 lb., at $0.065	439	3 10-ft. extensions for dead-end towers, 2,690 lb., at $0.065	524
2 20-ft. extensions for dead-end towers, 3,900 lb., at $0.065	507	2 20-ft. extensions for dead-end towers, 3,900 lb., at $0.065	507	2 20-ft. extensions for dead-end towers, 4,660 lb., at $0.065	606
Concrete Footings (for dead-end towers):		*Concrete Footings* (for dead-end towers):		*Concrete Footings* (for dead-end towers):	
396 yd. at $20 per yd.	7,920	396 yd. at $20 per yd.	7,920	492 yd., at $20 per yd.	9,840
Conductor:		*Conductor:*		*Conductor:*	
No. 4/0 hard-drawn stranded copper, 185.4 miles, 3,488 lb. per mile, at $0.1925	124,500	No. 4/0 hard-drawn stranded copper, 185.4 miles, 3,488 lb. per mile at $0.1925	124,500	No. 4/0 hard-drawn stranded copper, 185.4 miles, 3,488 lb. per mile, at $0.1925	124,500
As an alternative:		As an alternative:		As an alternative:	
336,400-circ.mil A.C.S.R., 185.4 miles, 2,788 lb. per mile, at $0.2175	112,500	336,400-circ.mil A.C.S.R., 185.4 miles at 2,788 lb. per mile, at $0.2175	112,500	336,400-circ.mil A.C.S.R., 185.4 miles, 2,788 lb. per mile, at $0.2175	112,500
Ground Wire:		*Ground Wire:*		*Ground Wire:*	
7/16-in. galvanized high-strength steel-strand, 30.9 miles at $152.70	4,720	7/16-in. galvanized high-strength steel-strand, 30.9 miles, at $152.70	4,720	7/16-in. galvanized high-strength steel-strand, 30.9 miles at $152.70	4,720
Insulators:		*Insulators:*		*Insulators:*	
5 per string on suspension towers = 5,700, at $2.30	13,110	8 per string on suspension towers = 9,120, at $2.30	20,990	9 per string on suspension towers = 10,260, at $2.30	23,600
7 per string on semi-dead-end towers = 2,688, at $3.00	8,064	10 per string on semi-dead-end towers = 3,840, at $3.00	11,520	11 per string on semi-dead-end towers = 4,224, at $3.00	12,680
7 per string on dead-end towers = 1,512, at $3.00	4,536	10 per string on dead-end towers = 2,160, at $3.00	6,480	11 per string on dead-end towers = 2,376, at $3.00	7,130
Line Hardware:		*Line Hardware:*		*Line Hardware:*	
1,140 suspension clamps with arcing horns, at $1.16	1,322	1,140 suspension clamps with arcing horns, at $1.16	1,322	1,140 suspension clamps with arcing horns, at $1.16	1,322
384 semi-dead-end clamps with arcing horns, at $3.34	1,283	384 semi-dead-end clamps with arcing horns, at $3.34	1,283	384 semi-dead-end clamps with arcing horns, at $3.34	1,283
216 dead-end clamps with arcing horns, at $2.34	506	216 dead-end clamps with arcing horns, at $2.34	506	216 dead-end clamps with arcing horns, at $2.34	506
1,740 hooks, at $0.25	435	1,740 hooks, at $0.25	435	1,740 hooks, at $0.25	455
1,140 upper arcing horns, at $0.40	456	1,140 upper arcing horns, at $0.40	456	1,140 upper arcing horns, at $0.40	456
600 upper arcing horns, at $0.34	204	600 upper arcing horns, at $0.34	204	600 upper arcing horns, at $0.34	204
Freight:		*Freight:*		*Freight:*	
$200 per mile of line	6,000	$200 per mile of line	6,000	$250 per mile of line	7,500
Labor		**Labor**		**Labor**	
Clearing Right-of-Way:		*Clearing Right-of-Way:*		*Clearing Right-of-Way:*	
$250 per mile	$7,500	$250 per mile	$7,500	$250 per mile	7,500
Excavation and Backfill:		*Excavation and Backfill:*		*Excavation and Backfill:*	
2,252 yd. earth (20 per cent wet excavation), at $3.75 per cu.yd.	8,450	2,252 yd. earth (20 per cent wet excavation), at $3.75 per cu.yd.	8,450	2,768 yd. earth (20 per cent wet excavation), at $3.75 per cu.yd.	10,370
563 yd. rock, at $10.60 per cu.yd.	5,965	563 yd. rock, at $10.60 per cu.yd.	5,965	692 yd. rock, at $10.60 per cu.yd.	7,330
Note: Rock excavation is assumed to be 20 per cent of total excavation.		Note: Rock excavation is assumed to be 20 per cent of total excavation.		Note: Rock excavation is assumed to be 20 per cent of total excavation.	
Tower Erection:		*Tower Erection:*		*Tower Erection:*	
240 towers, at $95	$22,800	240 towers, at $95	22,800	240 towers, at $110	26,400
Stringing Conductors and Installing Insulators:		*Stringing Conductors and Installing Insulators:*		*Stringing Conductors and Installing Insulators:*	
185.4 miles, at $80	14,830	185.4 miles, at $83	15,380	185.4 miles, at $85	15,750
Stringing Ground Wire:		*Stringing Ground Wire:*		*Stringing Ground Wire:*	
30.9 miles, at $50	1,545	30.9 miles, at $50	1,545	30.9 miles, at $50	1,545
Distributing Material:		*Distributing Material:*		*Distributing Material:*	
30 miles, at $350	10,500	30 miles, at $350	10,500	30 miles, at $400	12,000
Engineering and Supervision:		*Engineering and Supervision:*		*Engineering and Supervision:*	
30 miles, at $250	7,500	30 miles, at $250	7,500	30 miles, at $250	7,500
Contingency—10 per cent	47,285	*Contingency*—10 per cent	48,668	*Contingency*—10 per cent	53,398
	$520,139		$535,352		$587,382
Interest During Construction:		*Interest During Construction:*		*Interest During Construction:*	
50 per cent of total for one year, at 8 per cent	20,800	50 per cent of total for one year, at 8 per cent	21,414	50 per cent of total for one year, at 8 per cent	23,495
	$540,939		$556,766		$610,877
Total cost per mile	18,031	Total cost per mile	18,559	Total cost per mile	20,362

* Conductors spaced for operation at 110 kv.

* Conductors spaced for operation at 110 kv.

Table III—Detailed Costs of Tap Substations

66 KV.	
Land and Structure	
Land, 1½ acres, at $1,500	$2,250
Structural steel, 49,130 lb., at $0.055	2,702
Rails, 13,330 lb., at $0.03	400
Concrete in place, 340 yd., at $16	5,440
Copper for low-tension bus, 975 lb., at $0.195	190
1½-in. galvanized-iron pipe for high-tension bus, 660 ft. at $0.19	125
Fencing, erected, 550 ft., at $2.50	1,375
Switchboard building, 25 ft. x 25 ft. x 17 ft. at $0.40	4,250
Conduit for control wiring	440
Transformer transfer car	525
Miscellaneous material	1,200
Total	$18,897
Equipment	
For installation outdoors:	
7 1,000-kva., 66,000/11,000-volt transformers*	$32,725
2 400-amp., 66,000-volt oil circuit breakers, rupturing capacity 1,000,000 kva.†	32,669
7 300-amp., 66,000-volt TPST gang-operated disconnecting switches	
2 66,000-volt oxide-film lightning arresters	
6 200-amp. suspension-type choke coils	
38 66,000-volt bus supports	
2 400-amp., 15,000-volt oil circuit breakers, rupturing capacity 400,000 kva.	
9 300-amp., 15,000-volt SPST disconnecting switches	
6 300-amp., 11,000-volt current transformers	
2 11,000-volt potential transformers	
3 11,000-volt, fused disconnecting switches	
72 11,000-volt bus supports	
For installation indoors:	
2 incoming line panels	
1 direct-current battery panel	
1 storage battery	
1 battery-charging set	
3 5-kva., 11,000/110-220-volt station service transformers	
Freight on equipment and structural material	900
Total	66,294
Labor	
Erection and wiring	$3,500
Cartage and rigging	2,200
Engineering and supervision	1,500
Total	$7,200
Contingency—10 per cent	9,239
Interest During Construction:	
50 per cent of total for 6 months, at 8 per cent	2,032
Grand total	$103,662
*7 1,667-kva., 66,000/11,000-volt transformers	$43,225
7 2,500-kva., 66,000/11,000-volt transformers	53,900
7 3,333-kva., 66,000/11,000-volt transformers	65,100
7 5,000-kva., 66,000/11,000-volt transformers	86,450

† To substitute oil circuit breakers having rupturing capacity of 500,000 kva. for those listed, deduct $4,170 from price of switchboard equipment.

110 KV.	
Land and Structure	
(For itemized estimate see under "66 Kv.")	$18,897
Equipment	
For installation outdoors:	
7 1,000-kva., 110,000/11,000-volt transformers*	$46,375
2 400-amp., 110,000-volt oil circuit breakers, rupturing capacity 500,000 kva.†	50,635
7 300-amp., 110,000-volt TPST gang-operated disconnecting switches	
2 110,000-volt oxide-film lightning arresters	
6 200-amp. suspension-type choke coils	
38 110,000-volt bus supports	
2 400-amp., 15,000-volt oil circuit breakers, rupturing capacity 400,000 kva.	
9 300-amp., 15,000-volt SPST disconnecting switches	
6 300-amp., 11,000-volt current transformers	
2 11,000-volt potential transformers	
3 11,000-volt fused disconnecting switches	
72 11,000-volt bus supports	
For installation indoors:	
2 incoming line panels	
1 direct-current battery panel	
1 storage battery	
1 Battery-charging set	
3 5-kva., 11,000/110-220-volt station service transformers	
Freight on equipment and structural material	1,100
Total	$98,110
Labor	
Erection and wiring	$3,800
Cartage and rigging	2,500
Engineering and supervision	1,600
Total	$7,900
Contingency—10 per cent	12,490
Interest During Construction:	
50 per cent of total for six months, at 8 per cent	2,748
Grand total	$140,145
*7 1,667-kva., 110,000/11,000-volt transformers	$57,925
7 2,500-kva., 110,000/11,000-volt transformers	71,295
7 3,333-kva., 110,000/11,000-volt transformers	85,050
7 5,000-kva., 110,000/11,000-volt transformers	108,850

† To substitute breakers having larger rupturing capacity make additions as follows to price of switchboard equipment: Rupturing capacity 750,000 kva. add $4,263; rupturing capacity 1,000,000 kva., add $7,015.

132 KV.	
Land and Structure	
Land, 1½ acres, at $1,500	$2,250
Structural steel, 53,430 lb., at $0.055	2,940
Rails, 14,250 lb., at $0.03	428
Concrete in place, 340 yd., at $16	5,440
Copper for low-tension bus, 975 lb., at $0.195	190
1½-in. galvanized-iron pipe for high-tension bus, 750-ft., at $0.19	142
Fencing, erected, 575 ft. @ $2.50	1,438
Switchboard building, 25 ft. x 25 ft. x 17 ft., at $0.40	4,250
Conduit for control wiring	450
Transformer transfer car	525
Miscellaneous material	1,200
Total	$19,253
Equipment	
For installation outdoors:	
7 1,000-kva., 132,000/11,000-volt transformers*	$60,025
2 400-amp., 13,200-volt oil circuit breakers, rupturing capacity 560,000 kva.†	70,717
7 300-amp., 13,200-volt TPST gang-operated disconnecting switches	
2 132,000-volt oxide-film lightning arresters	
6 200-amp. choke coils	
38 132,000-volt bus supports	
2 400-amp., 15,000-volt oil circuit breakers, rupturing capacity 400,000 kva.	
9 300-amp., 15,000-volt SPST disconnecting switches	
6 300-amp. current transformers	
2 11,000-volt potential transformers	
3 11,000-volt fused disconnecting switches	
72 11,000-volt bus supports	
For installation indoors:	
2 incoming line and transformer panels	
1 battery panel	
1 storage battery	
1 battery-charging set	
3 5-kva., 11,000/110-220-volt station service transformers	
Freight on equipment and structural material	1,250
Total	$131,992
Labor	
Erection and wiring	$4,100
Cartage and rigging	2,800
Engineering and supervision	1,700
Total	$8,600
Contingency—10 per cent	15,985
Interest During Construction:	
50 per cent of total for six months, at 8 per cent	3,516
Grand total	$179,346
*7 1,667-kva., 132,000/11,000-volt transformers	$69,510
7 2,500-kva., 132,000/11,000-volt transformers	84,175
7 3,333-kva., 132,000/11,000-volt transformers	98,000
7 5,000-kva., 132,000/11,000-volt transformers	122,255

† To substitute oil circuit breakers having rupturing capacity of 842,000-kva. for those listed, add $4,200 to price of switchboard equipment. To substitute oil circuit breakers having rupturing capacity of 1,500,000 kva. for those listed, add $6,082 to price of switchboard equipment.

Table IV—Detailed Costs of Sectionalizing Substation

66 KV.	
Land and Structure	
Land, 2 acres, at $1,500	$3,000
Structural steel, 112,580 lb., at $0.055	6,192
Rails, 13,330 lb., at $0.03	400
Concrete in place, 477 yd., at $16	7,632
Copper for low-tension bus, 975 lb., at $0.195	190
1½-in. galvanized pipe for high-tension bus, 2,200 ft., at $0.19	418
Fencing, erected, 750 ft., at $2.50	1,875
Switchboard building, 30 ft. x 30 ft. x 17 ft., at $0.40	6,120
Conduit for control wiring	800
Transformer transfer car	525
Miscellaneous material	2,000
Total	$29,152
Equipment	
For installation outdoors:	
7 2,500-kva., 66,000/11,000-volt transformers*	$53,900
6 400-amp., 66,000-volt oil circuit breakers, rupturing capacity 1,000,000 kva.†	69,988
16 300-amp., 66,000-volt TPST gang-operated disconnecting switches	
2 66,000-volt oxide-film lightning arresters	
112 66,000-volt bus supports	
6 200-amp. suspension choke coils	
2 400-amp., 15,000-volt oil circuit breakers, rupturing capacity 400,000 kva.	
9 600-amp., 15,000-volt SPST disconnecting switches	
6 500-amp., 11,000-volt current transformers	
2 11,000-volt potential transformers	
3 11,000-volt fused disconnecting switches	
72 11,000-volt bus-supports	
For installation indoors:	
2 incoming line panels	
2 transformer panels	
1 battery panel	
1 storage panel	
1 battery-charging set	
3 5-kva., 11,000/110-220-volt station service transformers	
Freight on equipment and structural material	1,900
Total	$125,788
Labor	
Erection and wiring	$5,000
Cartage and rigging	2,500
Engineering and supervision	1,800
Total	$9,300
Contingency—10 per cent	16,400
Interest During Construction:	
50 per cent of total for six months, at 8 per cent	3,613
Grand total	$184,253
*7 3,333-kva., 66,000/11,000-volt transformers	$65,100
7 5,000-kva., 66,000/11,000-volt transformers	86,450

† To substitute oil circuit breakers having a rupturing capacity of 500,000 kva. for those listed, deduct $12,110 from price of switchboard equipment.

110 KV.	
Land and Structure	
(For itemized estimate see under "66 Kv."	$29,152
Equipment	
For installation outdoors:	
7 2,500-kva., 110,000/11,000-volt transformers*	$71,295
6 400-amp., 110,000-volt oil circuit breakers, rupturing capacity 500,000 kva.†	103,676
16 300-amp., 110,000-volt TPST gang-operated disconnecting switches	
2 110,000-volt oxide-film lightning arresters	
112 110,000-volt bus supports	
6 200-amp. suspension choke coils	
2 400-amp., 15,000-volt oil circuit breakers, rupturing capacity 400,000 kva.	
9 600-amp., 15,000-volt SPST disconnecting switches	
6 500-amp., 11,000-volt current transformers	
2 11,000-volt potential transformers	
3 11,000-volt fused disconnecting switches	
72 11,000-volt bus supports	
For installation indoors:	
2 incoming line panels	
2 transformer panels	
1 battery panel	
1 storage battery	
1 battery-charging set	
3 5-kva., 11,000/110-220-volt station service, transformers	
Freight on equipment and structural material	2,300
Total	$177,271
Labor	
Erection and wiring	$5,300
Cartage and rigging	2,800
Engineering and supervision	1,850
Total	$9,950
Contingency—10 per cent	21,640
Interest During Construction:	
50 per cent of total for six months, at 8 per cent	4,760
Grand total	$242,773
*7 3,333-kva. 110,000/11,000-volt transformers	$85,050
7 5,000-kva. 110,000/11,000-volt transformers	108,850

† To substitute breakers having larger rupturing capacity make additions as follows to price of switchboard equipment: Rupturing capacity 750,000 kva., add $11,823; rupturing capacity 1,000,000 kva., add $19,615.

132 KV.	
Land and Structure	
Land, 2 acres, at $1,500	$3,000
Structural steel, 127,025 lb., at $0.55	6,986
Rails, 14,250 lb., at $0.03	428
Concrete in place, 477 yd., at $16	7,632
Copper for low-tension bus, 975 lb., at $0.195	190
1½-in. galvanized pipe for high-tension bus, 2,500-ft., at $0.19	475
Fencing, erected, 830 ft., at $2.50	2,075
Switchboard building, 30 ft. x 30 ft. x 17 ft., at $0.40	6,120
Conduit for control wiring	825
Transformer transfer car	525
Miscellaneous material	2,000
Total	$30,256
Equipment	
For installation outdoors:	
7 2,500-kva., 132,000/11,000-volt transformers*	$84,175
6 400-amp., 132,000-volt oil circuit breakers, rupturing capacity 560,000 kva.†	138,958
16 300-amp., 132,000-volt TPST gang-operated disconnecting switches	
2 132,000-volt oxide-film lightning arresters	
112 132,000-volt bus supports	
6 200-amp. suspension choke coils	
2 400-amp., 15,000-volt oil circuit breakers, rupturing capacity 400,000 kva.	
9 600-amp., 15,000-volt SPST disconnecting switches	
6 500-amp., 11,000-volt current transformers	
2 11,000-volt potential transformers	
3 11,000-volt fused disconnecting switches	
72 11,000-volt bus supports	
For installation indoors:	
2 incoming line panels	
2 transformer panels	
1 battery panel	
1 storage battery	
1 battery-charging set	
3 5-kva., 11,000/110-220-volt station service transformers	
Freight on equipment and structural material	$2,700
Total	$225,833
Labor	
Erection and wiring	$5,800
Cartage and rigging	3,100
Engineering and supervision	1,950
Total	$10,850
Contingency—10 per cent	26,694
Interest During Construction:	
50 per cent of total for six months, at 8 per cent	5,873
Grand total	$299,506
*7 3,333-kva., 132,000/11,000-volt transformers	$98,000
7 5,000-kva., 132,000/11,000-volt transformers	122,255

† To substitute oil circuit breakers having rupturing capacity of 842,000 kva. for those listed, add $12,600 to price of switchboard equipment. To substitute oil circuit breakers having rupturing capacity of 1,500,000 kva. for those listed, add $17,202 to price of switchboard equipment.

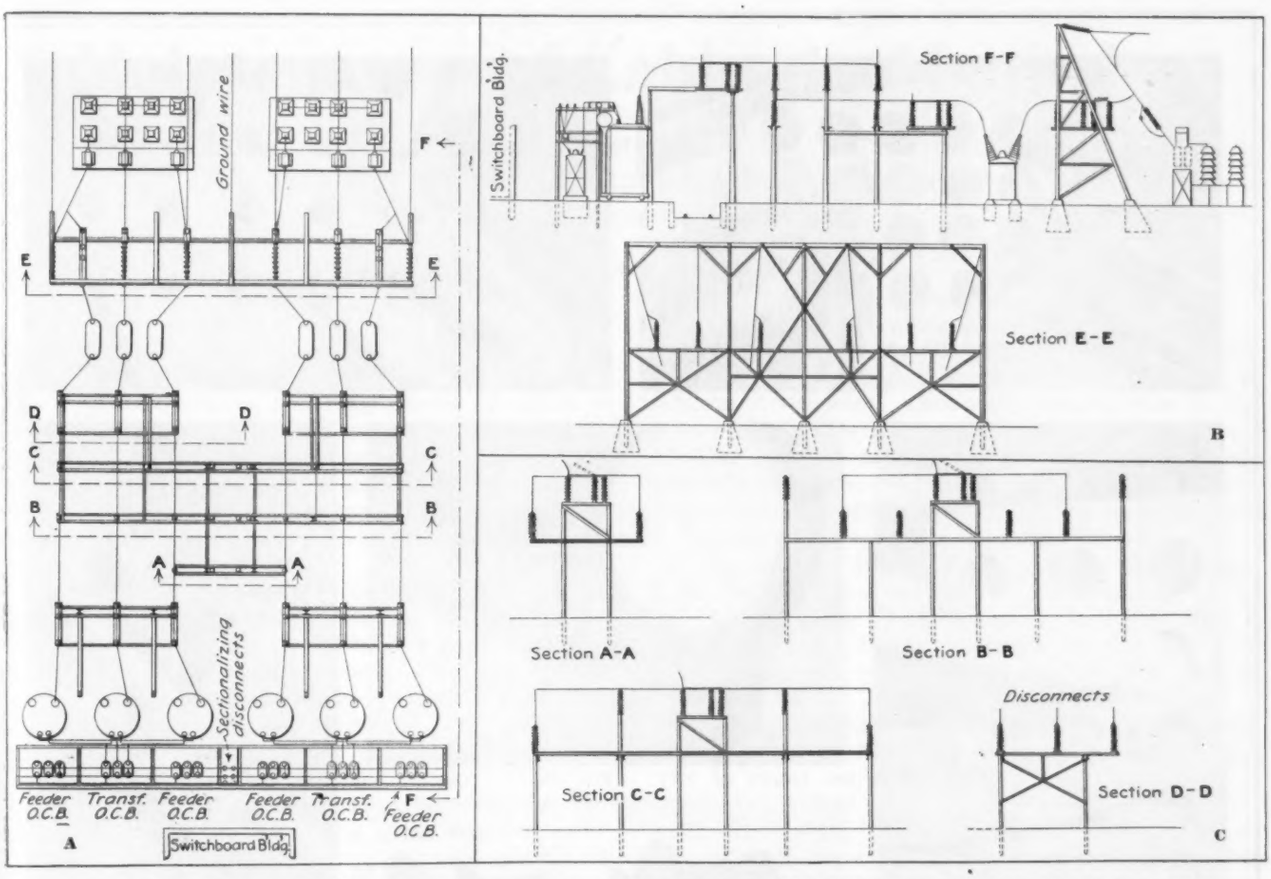


FIG. 3—(A) PLAN OF 110,000-VOLT TAP SUBSTATION; (B) SECTION OF 110,000-VOLT TAP SUBSTATION; (C) DETAILS OF 110,000-VOLT TAP SUBSTATION

cal, 20 ft. horizontal, with middle conductor offset 3 ft. outward on each side of tower. The minimum clearance to earth is 25 ft. The maximum cable loading is 8 lb. per square foot wind pressure on the projected area of the conductor, when the latter is covered with ½-in. thickness of ice.

Ground Wire.—A ground wire was included to insure positive grounding of all structures, to insure positive relaying and for lightning protection.

Insulators.—Insulators were used as follows:

Line Voltage	Number of Units in Suspension	Number of Units at Dead Ends
66,000	5	7
110,000	8	10
132,000	9	11

Standard 10-in. units are used on suspension towers. To avoid the use of yokes high-strength units are used at semi-dead-end and dead-end structures.

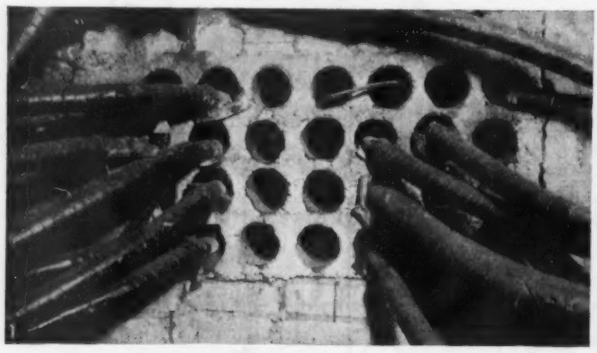
Conductors.—The line costs are based on a conductor size of No. 4/0 copper or equivalent in steel-core aluminum. This size was fixed after a consideration of practice on most of the large transmission systems of this country as being in line with the requirements of interconnecting transmission lines. No. 4/0 conductors provide sufficient conductivity for the interchange anticipated, but excessive corona loss is to be expected if larger conductors are not used, at elevations above sea level, with 132,000-volt transmission.

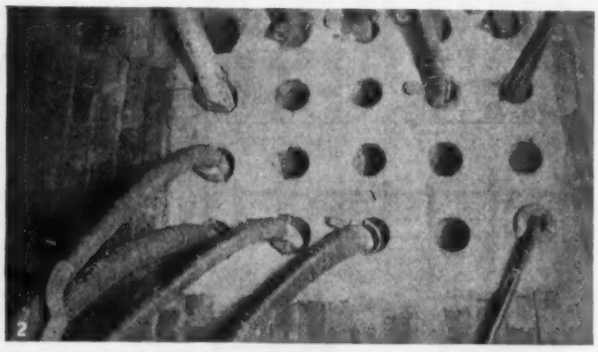
Telephone Facilities.—No telephone line is included in the estimate. For the purpose of load dispatching the transmission line itself may be used for telephoning by means of carrier-current telephony. Line patrolmen's telephone stations may be connected to the lines of the telephone company at convenient points.

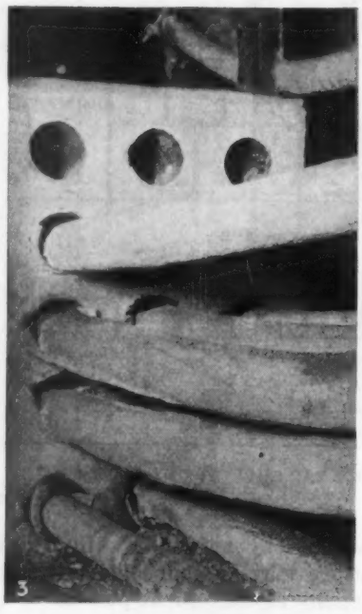
Two types of substations are covered by the estimates—first, a tap substation to be installed solely for the purpose of taking power from the lines; second, a sectionalizing substation to be installed at points where the transmission circuits are to be sectionalized. The accompanying illustrations show the equipment and its arrangement. The estimates given cover the cost of the substations equipped with various probable sizes of transformers and oil circuit breakers. The low-tension bus voltage is 11,000 in all cases. No equipment on outgoing low-tension feeders is included in the estimates. All substation equipment is for 60-cycle service.

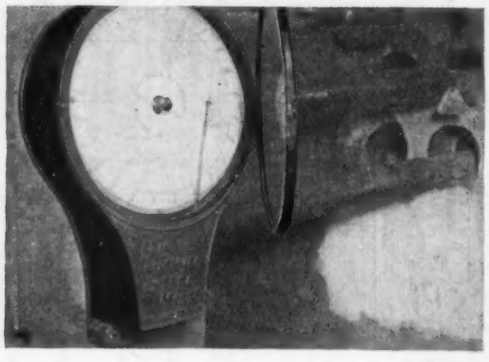
Substation transformers are all single-phase self-cooled units equipped with ratio adjusters. All transformer banks are star-connected on the high-tension side and delta-connected on the low-tension side. Substations are arranged for operation with the high-tension neutral grounded, but insulation is provided for the neutral bus in case a ground resistance is used or non-grounded operation desired.

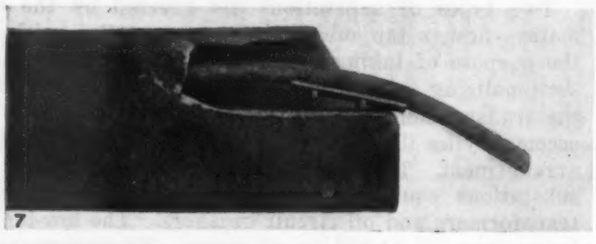
The complete membership of the transmission lines committee which compiled the report consisted of E. P. Peck, chairman; C. A. Bacon, O. H. Bundy, S. Piek, W. C. Fisher, William Nesbit, H. M. Brinckerhoff, C. A. Davis, H. Goodwin, Jr., John L. Harper, R. A. Paine, Jr., W. C. Pearce, H. G. Davis, Sydney Alling, H. L. Kneisley, H. R. Cox, T. S. Worcester. Sydney Alling and Messrs. Kneisley, Cox, Worcester and Piek formed the sub-committee which compiled the data on line and substation costs.

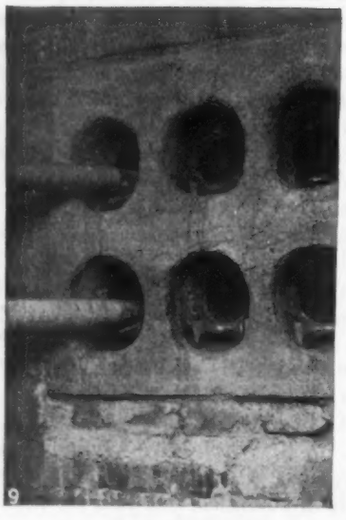












Why Good Duct Construction Is Needed

Fig. 1—Old-style duct construction. Too many ducts are used. They are too close together. Wood or lead cushions are used, and asbestos paper is used for fire protection.

Fig. 2—Later type of duct construction. Note the wider duct spacing.

Fig. 3—Ducts not sufficiently separated. Concrete fire protection is used and lead cushions. The protection cannot be extended into the ducts.

Fig. 4—Measuring the extent of the expansion and contraction of a cable. This is readily done by using a graphic meter with a line attached to the meter pointer and the cable.

Fig. 5—Lead cushion forced out of duct and damaged lead sheath.

Fig. 6—Types of shields used that can be forced out of ducts. Note wear on the lead shields.

Fig. 7—Great care must be used with shields to get a correct angle between cable and shield.

Fig. 8—Roller-support duct end devices, showing removable form for concreting. The smaller type is used where ducts are closely spaced.

Fig. 9—Usual construction of duct ends using larger roller supports. The roller is removable; no lubricant is required; fire protection can be extended into the duct opening without rubbing.

Fig. 10—Large duct-end roller-support device installed in duct-end model.

Maintenance of Cables in Manholes

Discussion of Fire Protection Methods and Duct-End Protection—Tests on Fire Protection Applications—Description of Duct-End Protective Device

By F. L. ROHRBACH
Engineer of Underground System, Washington Water Power Company

DURING the last two or three years more attention than formerly has been given to the operation and maintenance of cables in manholes. In most cases the manholes and conduit lines have been designed and built by one department and the cables installed and operated by another. As a result cables are usually installed to fit the duct line instead of the duct line being built for the proper operation of cables.

In the past manholes have usually been too small and the conduit lines have contained too many ducts. These two conditions have made it all the harder to install and operate cables properly. The best practice at present is to build manholes at least 6 ft. square, preferably with rounded corners, and to install not more than fourteen or sixteen ducts in a run. With manholes and duct lines installed properly there are still two very important things to be observed, fire protection of cables and duct-ending at the manhole.

Fire Protection of Cables

Special protection by brick or transite board is sometimes used, but it is not applicable to all cables and the cost is very high. For cables in general some form of concrete or asbestos is used. Both the cost and the degree of protection vary according to the method of application. Methods in common use are:

1. Concrete with ¼-in. rope.
2. Concrete with metal lath (do not use on single conduit or with alternating current).
3. Asbestos tape and waterglass.
4. Asbestos paper and waterglass.
5. Asbestos paper and steel tape (do not use on single conduit or with alternating current).

The methods of installing and using these applications may be outlined as follows:

1. Paint the lead sheath with waterglass. Soak the rope in water and coil it around the cable, leaving ¼ in. space between turns. Then apply concrete (one part cement, two parts sand) from $\frac{7}{16}$ in. to $\frac{9}{16}$ in. over the sheath.

TABLE I—COMPARISON OF COSTS PER LINEAR FOOT OF 1,000,000-CIRC.MIL CABLE

(Based on protecting two cables in a manhole and then moving equipment to the next manhole)

Type	Material, Cents	Labor, at 50 Cents per Hour, Cents	Total, Cents	Remarks
1	6	12	18	.....
2	10	10	20	.....
3	31	4	35	.....
4	4	8	12	Two layers
4	8	12	20	Four layers
4	12	16	28	Six layers
5	8	14	22	.....

Unit costs: Rope, 1 cent per linear foot; cement, $3.75 barrel; sand, $2 per yard; metal lath, 5 cents per square foot; roll of asbestos paper, weight 100 lb., $10; galvanized iron, No. 28 gage, 30 in. x 96 in. $1.10; woven asbestos tape, 6 cents per foot.

2. Paint the lead sheath with waterglass. Cut the metal lath in strips and form it around the cable, fastening it with wire. Then apply concrete from $\frac{5}{16}$ in. to $\frac{6}{16}$ in. over the sheath.

3. Use asbestos tape 2 in. wide and $\frac{1}{16}$ in. thick. Soak it in waterglass and then wrap it around the cable, lapping one-half, after which give it one or more coats of waterglass.

4. Use asbestos paper (22 lb. per 100 sq.ft.) about $\frac{1}{16}$ in. thick and cut in strips 2 in. wide. Wrap the first layer of paper in one direction and then paint it with waterglass. Wrap the second layer in the opposite direction and paint it with one or more coats of waterglass.

5. Use two layers of asbestos paper as in paragraph 4 and then wrap with one layer of galvanized tape (No. 28 gage) cut ¾ in. wide.

Costs and Tests

Samples of the types given were made up by protecting 12-in. lengths of 1,000,000-circ.mil cable having $\frac{4}{32}$-in. lead sheath. The stranded copper and insulation were then removed so that the first indication of sheath failure could be noted by looking lengthwise through the lead sheath. The comparative costs are given in Table I.

Tests were made by heating the samples over a cableman's gasoline furnace, a metal strip being placed so as to distribute the heat. The results of the tests are given in Table II.

TABLE II—TESTS OF SAMPLE CABLES

Type	First Indication of Sheath Melting Min.	Sec.	Remarks
1	6	20	$\frac{1}{16}$-in. rope, $\frac{5}{16}$-in. concrete over lead
2	3	40	Metal lath, $\frac{1}{16}$-in. concrete over lead
3	1	35	$\frac{1}{16}$-in. asbestos tape, two layers
3	1	10	$\frac{1}{16}$-in. asbestos tape, two layers
4	1	45	$\frac{1}{16}$-in. asbestos paper, two layers
4	2	30	$\frac{1}{16}$-in. asbestos paper, three layers
4	3	30	$\frac{1}{16}$-in. asbestos paper, four layers
4	5	45	$\frac{1}{16}$-in. asbestos paper, six layers
5	1	40	$\frac{1}{16}$-in. asbestos paper, two layers and 1 steel tape

The time noted was the elapsed time for sufficient heat to pass through the protection and melt a spot through the lead sheath.

In case of a manhole fire lasting for some time there is no question in my opinion that concrete protection is by far the best. I have had several experiences where the asbestos tape or paper has been reduced to ashes, thus allowing the insulation proper of the cable to be destroyed. On the other hand, concrete, no matter how hot, will retain its shape and thus protect the cable insulation by preventing air getting to it in sufficient quantity to aid combustion.

The one objection to concrete is that it is seriously damaged by the expansion and contraction which occurs

in all cables owing to the heating and cooling of the conductor caused by the varying load. Most of the damage can be prevented by installing the cable with the proper bends and taking especial care that it is free to move on the brackets. Reverse curves or sharp bends should be avoided. Where the protection at a particular place is frequently damaged, it can be helped, when repaired, by using a layer of garden hose or other suitable material under the concrete. This soft material will take the force of the expansion and prevent damage.

DUCT-END CONSTRUCTION IN MANHOLES

Probably more serious cable breakdowns occur at the manhole duct end than at any other place on the system. These burn-outs are caused by several conditions—the cables are closer together, expansion and contraction of cables cause very serious wear of the sheath on the duct edge, and fire protection usually stops from 1 in. to 3 in. from the duct entrance.

The oldest duct lines were built mainly of multiple-tile duct and no attempt was made to separate the ducts at their ends. After some time, when fiber ducts and single-tile ducts were introduced, more attention was given to the question of spreading out the ducts at their entrance into the manhole. Later on the idea of belling the duct mouth was introduced, so that at the present time provision is made for separating the cables and for carrying the fire protection into the duct end.

Apparently very little has been done to avoid the wear on the sheath at the duct edge, except to install cushions of wood, leather, metal or lead. In many instances these cushions are worn through or are pushed out into the manhole and the lead sheath must then take the wear. There is no question that the majority of burn-outs in the manhole could be avoided by preventing this filing effect at the duct edge. Belling the duct mouth helps, but this alone will not prevent the damage. When the extent of the movement of cables and the weight that must be supported at this point are appreciated, it is evident that damage can be avoided only by the proper support of the cable.

Cables are sometimes cemented at the duct mouth to restrain them, thus preventing wear on the sheath. This is objectionable because the conductor might move independently of the sheath and because all ventilation at the duct mouth is stopped.

If an average length of cable installed between two manholes is considered, it will be found that the cable at the center of the line remains at rest under all changes of load. From the center point and going toward the mouth of each manhole the movement increases, and it is greatest at the duct end. There is more or less wear along the full length of the duct, but as the cable is supported at virtually every point, the damage is slight as compared with that at the duct edge where the cable must form an angle. This means that the duct edge supports at least from 2 ft. to 3 ft. of cable in addition to the weight of the fire protection.

The Washington Water Power Company, Spokane, Wash., has adopted a duct-ending device,* the installation and details of which are clearly shown in the pictures on page 1164. Many experiments were made, movements of cables were measured, wear and displacement of different types of cushions were noted, and several kinds of movable supports were tried out.

The installation of this device solves several problems. First, it gives a spreading duct line; second, it allows the fire protection to be carried into the duct mouth and also prevents it from rubbing on the duct; third, most important of all, it prevents wear on the lead sheath, thereby cutting down the expense of inspection and removing the breakdown hazard at this point.

October Activities 6.6 per Cent Above Normal

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate that activities in many of the industries of the country were further curtailed during October. All the main industries which influence activity in the electrical industry reported de-

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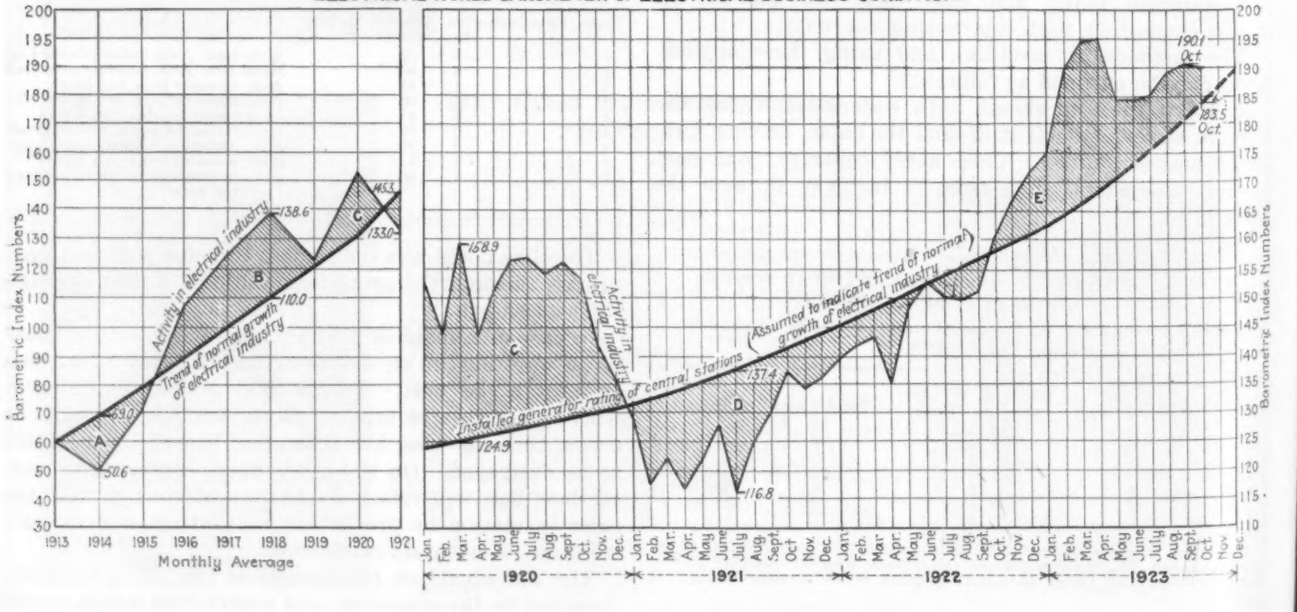
ELECTRICAL WORLD BAROMETER OF ELECTRICAL BUSINESS CONDITIONS



creased activity during October as compared with September—that is, when referred to their respective normal growths.

The data upon which the "ELECTRICAL WORLD Barometer" is based indicate a decrease of 0.6 point on the scale as compared with September activities. During this interval the industry has grown 2.7 points, leaving a net decrease in activities of 3.3 points on the barometer scale as compared with September. The electrical industry as a whole was operating in October at 6.6 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In September it was operating at 9.9 and in August at 11.3 points or per cent above the point of normal demand.

The Outlook for Utilities

President Walter H. Johnson of the N. E. L. A. Presents Facts and Figures of Vital Interest to Electric Service Companies

AN ADDRESS full of facts and figures regarding the growth of the public utility industry, definitely planned special expenditures for the coming year, capitalization, extent of customer ownership, the problems of rural service and transcontinental superpower lines was presented by Walter H. Johnson, president of the National Electric Light Association, at the convention of the Great Lakes Geographic Division in French Lick recently.

Mr. Johnson, admitting the imperative necessity for the industry to expand, said that none the less it is a mistake to let it grow too fast. The expenditures must be kept proportional to the income or to the definitely estimated increase in income. This year it is conservatively estimated that the energy output of central-station companies will reach 55,000,000,000 kw.-hr., or an increase of 15 per cent over 1922. In other words, there has been a greater increase in the last six years than in the previous twenty-five years. Sixty-five per cent of this amount will be generated from steam plants and 35 per cent from hydro-electric plants.

FINANCIAL PROBLEM ONE OF THE GREATEST

The financial problem is one of the greatest confronting the industry, Mr. Johnson declared. Projects costing $602,142,000 are actually known to be under construction and will be completed during the current year. It is estimated that the amount actually expended during 1923 will reach at least $650,000,000. This will bring the total investment in the electric light and power industry to $5,750,000,000. Despite this fact, the reduced rates which are being put into effect by many companies will permit them to increase their gross earnings only $70,000,000. To dissipate the misapprehension that utilities are owned by private interests, Mr. Johnson pointed out that their securities are held by 2,000,000 citizens and 29,000 banks. The banks have placed $1,700,000,000 belonging to 27,000,000 depositors, as an investment in these utilities.

The fact that one company alone reports that it is placing meters at the rate of 6,000 a month is an indication of the rate of increase in customers' service. It is estimated that by Dec. 31 of this year there will be 13,356,000 central-station company customers in the United States, or an increase of 1,150,000. Of these, 125,000 will be new commercial customers and 25,000 new power customers.

Extension of electric service to rural communities is another problem which is giving many company executives considerable concern. In this field there is great opportunity for development, coupled with considerable danger of overdevelopment, or at least too rapid development, being urged by the agricultural element and by political agitators. This development, even more than urban development, must be made upon a sound economic basis; it must be commercially practicable from the viewpoint both of the electric light and power companies and of the farmers. Mr. Johnson alluded to the steps being taken to solve the problem through the co-operation of the United States Department of Agriculture, the National Electric Light Association, the American Farm Bureau Federation, the American Association of Agricultural Engineers and isolated farm-plant manufacturers. Rural-line extension and the development of farm electrification are closely tied in with the so-called superpower development, he said. Whenever and wherever existing systems are interconnected and new distribution systems are built and interconnected the possibilities of extending service to the farmer are increased.

Superpower upon a national scale or upon any scale very much more extensive than that already under way will require considerable additional investment and new capital, the speaker went on. It is estimated that the national superpower plan, as outlined at the N. E. L. A. convention last June, would require a minimum of $5,000,000,000, an amount nearly equal to the total amount already invested in the industry. Since it is admitted that at least ten years would be required for building such a superpower system, an additional investment of $500,000,000 annually would be needed.

Today one-third of the entire population, living in 9,500,000 homes wired for electricity, are supplied with electric service, Mr. Johnson declared, and in 1920 more than 33,000,000,000 kw.-hr. of electrical energy was sold to industrial customers alone.

Water Powers of Czechoslovakia

THE Czechoslovak government, realizing the importance of coal as an item of export and the necessity of curtailing consumption of coal by domestic industries, is contemplating extensive improvements to develop and conserve the country's water power, according to a report by American Consul C. S. Winance, at Prague.

The most important project now under consideration is the building of three dams across the Thaya River, near the Austrian border. The first dam will be constructed between Bitov and Uranov, making a basin of 180,800,000 cu.m. content; the second dam will be near Podmole and will create a basin of 16,300,000 cu.m. content, and the third dam will be constructed at Znojmo and will create a basin of 7,000,000 cu.m. content. It is stated, the Consul says, that the dams of the Thaya will be the largest in Central Europe. The work has been begun under the direction of the Czechoslovakian national government and the Moravian provincial administration.

According to statements of experts, Czechoslovakia has water-power resources amounting to approximately 1,185,000 hp., with a possible annual production of 5,400,000,000 kw.-hr.

Who Sells Electrical Appliances?—I

A City of 500,000

"Electrical World" Survey of Retail Outlets for Electrical Merchandise, Showing Comparison of Sales by Electrical Dealers, Central-Station Company, Hardware and Department Stores, with Indications of the Trend

IN PRESENTING an analysis of the relative importance of the various retail outlets for electrical appliances in a given city it is interesting to know its size, the make-up of population and the nature of its industries and business. Such characteristics do not necessarily affect the electrical business more or less than they do any other business, but they do form an essential part of the picture for the purpose of comparison with conditions existing in other localities. The first city under consideration has a population of approximately half a million, including adjacent suburbs whose shoppers give most of their business to the local retail merchants. Approximately 80 per cent of this population are native-born, between 9 and 10 per cent are foreign-born and about the same percentage are colored. The city is situated in a highly developed agricultural section, and the chief industries are dependent upon the utilization of farm produce. The city is an important railroad center and because of its geographic location is particularly suited as a point of wholesale distribution.

Data on appliance sales have been confined to the principal devices sold by dealers of all classes in order that conditions in different cities may later be put on a comparable basis. Likewise, expressions by various retailers reflect their opinion upon fundamental principles or problems common to retail selling of electrical appliances. Four different classes of merchants—hardware stores, department stores, electrical contractors and dealers and the central-station company—were found to be the main retail outlets in this particular city.

There appears to be very little cohesion among the different branches of the electrical fraternity in the city. One man graphically termed it a "wildcat" town with respect to the wide variety and quality of merchandise sold. A movement is on foot, however, to form an electrical league with a paid executive manager, and it is hoped by this means to create a better spirit of co-operation. It is the aim to relieve price cutting on appliances and also to raise the general standard of electrical wiring. As the situation now exists there are a great many "basket" electricians.

Neither the department stores nor the hardware stores as a class figure largely in the total volume of appliance sales, although there is one store of each kind doing a very good business. The volume of business done by these stores and other retailers will be discussed in the order in which they were visited by a representative of the ELECTRICAL WORLD.

HARDWARE STORES

Hardware dealer "A" is one of the livest all-around merchants in the Middle West, and though bearing a certain reputation as a cut-price store, in actual practice the selling prices of articles are very close to customary figures. The standard lines of heating devices are sold at regular prices, and when leaders are offered they are merchandise specially purchased for the sale. One instance was that of a washer sold at a reduction on deferred payments. Sixty-eight of these were sold out of the store in one week. Extensive advertising is carried on in all of the principal newspapers. Much of this takes the form of "$1.98" and "$4.95" sales. The copy is good and resembles department-store advertising.

A most complete line is carried, including mangles and electric cookers. Electric appliances, according to the department manager, are one of the main items of the store's business. The volume of sales is increasing steadily, and the appliances form the best all-year-round merchandise in the store. Competition from the central station is considered fair and its advertising of benefit to other merchants.

The salesmen here appeared to be enthusiastic about electric devices and said that they were not difficult to sell; in fact, they enjoyed selling them. The amount of servicing has been comparatively small.

Hardware dealer "B" had an unfortunate experience with washing machines in that he was overstocked, had difficulty in moving them and is now retrenching on electrical appliances generally. He asserted that he was a hardware man, not in the house-furnishing business, and would stick to his own trade.

DEPARTMENT STORES

The one department store which is doing a large volume in appliances sells on deferred payments, and vacuum cleaners are handled on the resale plan. Outside salesmen are used and a service department is maintained. The merchandising manager here stated that the department store is one of the logical outlets for appliances as there is sufficient voluntary demand to make the business profitable.

Most purchases of electrical appliances are made direct from manufacturers, and thus discounts are satisfactory. Department stores, he stated, must be considered by the manufacturer on the same basis as a jobber and accorded the same discounts. The local central-station company, he felt, was not realizing as much as it could from appliance sales, partly because it had no outside sales force and partly because of the disinclination of some people to buy from the public utility. Competition was very keen because of the number of branch and specialty stores and price cutting by some of the dealers. He predicted that this business in the department store would increase rapidly for several years for two reasons: First, because the demand has not yet reached a point where it would level off and become steady, and, second, because more people are buying from department stores and not from dealers. He cited the fact that some fifteen electrical contractors who had engaged prominently in electrical merchandising had failed in the last three years. (This statement was later confirmed by the president of the contractors' association.)

Purpose of the Investigation

NOBODY knows today who is selling electrical appliances or the proportionate volume of sales by the different retail outlets. The need for more specific knowledge of the present status of the appliance business and the direction in which it is moving has become increasingly urgent. Electrical merchandise has assumed a most important position in the industry as a means of building up the residential load, as an important factor in public good will and as a source of profit to the manufacturer, jobber, dealer and central-station company. Because of this widespread interest the ELECTRICAL WORLD is conducting a personal investigation of the conditions now obtaining in representative cities throughout the country. It aims to determine by direct study, on the ground, who is selling the appliances, why and how many.

The ELECTRICAL WORLD survey has been undertaken with a view to setting forth the facts as found without attempting either to prove or disprove any theory, statement or premise. Opinions, when given in this or subsequent articles, bearing upon fundamental principles of the business are those expressed by the people interviewed. Observations of significant conditions are based upon definite trends or circumstances existing in a city. As most of the data and information are of a confidential nature, it is obviously impossible to publish the names of the localities surveyed, although certain peculiarities may enable readers to identify some of the cities.

THIS is the first of a series of articles to be published in the ELECTRICAL WORLD analyzing the volume and trend of retail sales of electrical appliances. The next will appear in an early issue, and when the series has been completed a composite analysis will be made.

Of the two other department stores, one carried only small appliances and the volume of sales was not large. The manager of the house-furnishing department stated that electrical merchandise was permanent in the store, but he believed that the growth of the business had been slow in their particular case. Deferred payments were not offered, and this store is not inclined to increase its stock until greater demand warrants. "Washers and cleaners," he said, "are too well represented by branch stores for us to engage in the business."

The third department store does not cater to installment payments, and this is reflected in its sales of washing machines and vacuum cleaners, which are very small. Other appliances of standard makes are carried and well displayed in the house-furnishing department. Not a great deal of advertising is given to electrical merchandising, and it appears that much of the business is of a seasonal nature. Most sales are made in the spring and around the holidays.

ELECTRICAL DEALERS

The dealers selling electrical appliances may be divided into three groups—factory branch or specialty stores, electric shops and contractors who also handle appliances. The factory branch is by far the most important, and it is rather difficult in some cases to differentiate between this and the electric store. Several of these are located in the heart of the shopping district and pay very high rentals. Competition is keen and not any too clean at times. Price cutting on standard makes of appliances is rather freely indulged in.

One store which sells only vacuum cleaners pays a rental of $13,000 a year for a comparatively small room. The manager declared that this paid because of the advertising value of keeping the name before the public and of having a good window for demonstration. Most of the sales, however, are made by outside men. During one week in August sixteen men had sold 107 cleaners, which was higher than the average for the year, as total sales are expected to reach 4,200.

This manager stated that the branch stores are responsible for the sale of 70 per cent of factory production, and this method has been found to be the most practicable way to train and control salesmen, put on campaigns and be sure of maintaining sales volume. Other factory branch stores were of virtually the same opinion, except those which have tied up with the central station or a department store under a resale contract.

It appears, as a general thing, that the manufacturers of electric appliances, especially the higher-priced ones, much prefer to be represented by the central-station company. This is natural, of course, in view of the established sales organization of the central station and its other advantages as an outlet for electrical merchandise.

The electric shops carry a varied line of appliances and do a good business. They are well located in the business section and they also pay high rentals. Competition is keen and various sales expedients are employed. Price cutting, the offering of premiums and rebating to the customer a part of a salesman's commission are the principal methods used to make or clinch a sale. While not exactly common practices, they are resorted to frequently. Little or no concern is felt by some of these shops as to the effect of their policy upon other dealers. The contractors are the most severe critics of the practice.

A number of the contractor-dealers in this city during the past three or four years have engaged in appliance selling on a rather large scale, but have dropped by the wayside for various reasons: First, merchandising is a side line for nearly all contractors, and when they engaged in this business they went at it on too ambitious a scale, without the proper selling equipment, location of store or familiarity with the business. Second, because of the smaller volume of purchases they were not able to earn as large a discount as were the department stores or some of the already established electric shops. Third, price cutting and keen competition generally are also given as reasons for their abandonment of merchandising. Fourth, factory branch and specialty stores occupy the field for the larger devices, and there is not a great opportunity for contractors to edge into the business

when it is conducted by them only as a small part of their total business.

An interesting comment on the general appliance situation was made by the manager of a factory branch which serves nine states. He pointed out that the electric appliance business is a house-to-house selling proposition so far as large appliances are concerned. This is particularly true of the contractor-dealer and the central-station company, because they do not have the crowds of shoppers in a buying frame of mind such as may be found in department stores and, to a less extent, in the hardware stores. All appliances must be sold, and while there is developing a certain amount of voluntary demand upon the part of customers, it is not such that the strictly electrical store or the central-station company, even, can depend upon it, with a certain amount of advertising, to make sales. He predicted that the small electric stores and contractor-dealers would gradually be eliminated as an outlet for electrical merchandise, and that out of the present transition period, which is very evident, there will be three merchandising plans very clearly defined, as follows:

1. Central-station companies will wake up to the fact that there is a very good profit to be made in merchandising and will handle the highest grades of articles in order to maintain a high standard of appliances on their lines. Selling policies will be formed which will closely parallel the department-store viewpoint, and the question of the energy-consumption value of appliances will not enter into the policy of whether or not the company should merchandise them.

2. Another outlet for electric appliances will be through local factory branches selling, perhaps, one or two large appliances which are the staple lines of the business, with a number of smaller devices carried as fillers. Such stores will depend to a large extent on the activities of outside salesmen, and their success will be determined by the attitude and capability of the local management. Stores of this kind would now be in much greater evidence throughout the country if it were possible to find a sufficient number of high-caliber salesmen to man the territories. The question of salesmen is one of the most serious which confront the electrical industry in retailing appliances.

3. A big volume of appliances will be sold through large stores, viz., department stores, hardware stores, central-station companies and a very few comparatively large electric specialty stores which put it straight up to manufacturers to standardize a method of selling and supply adequate co-operation in the form of national advertising, demonstration and sales assistance.

The development of salesmen appears to be the key to the solution of the selling problem, and it means the education and training of a large number of high-class men who can merchandise a specialty. Much of this training of salesmen will devolve upon the manufacturer of large appliances, because he cannot and should not expect the central-station company, or any other merchant, for that matter, to develop a market and a sales force for his products.

This factory branch manager estimated that in larger cities the central-station company is now selling approximately 25 per cent of the appliances in its territory, branch stores 37½ per cent and department and hardware stores another 37½ per cent of all appliances. At the end of five years the department and hardware stores will have so increased their sales that the totals will be about as follows: Central stations, 25 per cent; branch stores, 25 per cent, and department and hardware stores, 50 per cent.

From the trend of the last three years, this manager stated, central-station companies and branch stores have done the pioneer work in developing the market for appliances, and the department and hardware stores are now profiting and will continue to "cash in" on the opportunity which has developed. The department stores in the past could not afford to experiment or do any development work on new appliances, and they will sell only merchandise for which there is a marked demand. This point has now been reached, and the

SALES OF PRINCIPAL ELECTRIC APPLIANCES, SHOWING QUANTITY, VALUE AND PROPORTION SOLD BY HARDWARE STORES, DEPARTMENT STORES, ELECTRICAL DEALERS AND THE CENTRAL-STATION COMPANY

Kind of Dealer	Washing Machines	Vacuum Cleaners	Ironers	Flatirons	Curling Irons	Toasters	Percolators	Ranges	Total Sales Each Class of Store	Per Cent of Total for City
Hardware store—"A"	700	20	.....	450	750	350	150	12		
Hardware store—"B"	30	.....	.....	100	75	80	36	.....		
Total	730	20	.....	550	825	430	186	12		
Value	$91,250	$1,050	.....	$3,300	$3,712	$2,580	$2,232	$1,800	$105,824	7.6
Per cent of stores' electric appliance sales	86.2	1.0	.....	3.1	3.5	2.4	2.1	1.7		
Department store—"C"	350	500	.....	1,500	1,000	400	250	100		
Department store—"D"	6	12	.....	225	300	125	150	.....		
Department store—"E"	.....	.....	.....	350	200	150	80	.....		
Total	356	512	.....	2,075	1,500	675	480	100		
Value	$44,500	$26,870	.....	$12,450	$6,750	$4,050	$5,760	$15,000	$115,380	8.4
Per cent of stores' electric appliance sales	38.6	23.2		10.8	5.9	3.5	5.0	13.0		
Electrical dealer—"F"	300	.....	.....	100	100	75	40	100		
Electrical dealer—"G"	15	12	.....	300	200	100	100	.....		
Electrical dealer—"H"	225	350	20	225	125	125	80	10		
Electrical dealer—"I"	30	40	.....	100	100	60	36	.....		
Electrical dealer—"J"	24	36	.....	75	40	24	12	.....		
Electrical dealer—"K"	450	125	.....	300	250	175	48	.....		
Electrical dealer—"L"	.....	4,200	.....	.....	.....	.....	.....	.....		
Electrical dealer—"M"	350	125	.....	50	60	24	10	12		
Electrical dealer—"N"	325	.....	12	.....	.....	.....	.....	.....		
Electrical dealer—"O"	350	650	.....	125	150	48	25	.....		
Electrical dealer—"P"	100	75	.....	140	60	36	10	.....		
Electrical dealer—"Q"	400	.....	75	.....	.....	.....	.....	.....		
Electrical dealer—"R"	350	140	.....	80	40	30	15	.....		
Total	2,919	5,753	107	1,495	1,125	697	376	122		
Value	$364,375	$302,032	$16,050	$8,970	$5,062	$4,182	$3,512	$18,300	$722,483	52.5
Per cent of stores' electric appliance sales	50.4	41.7	2.2	1.3	0.7	0.6	0.5	2.6		
Central-station company	1,200	3,000	80	7,500	650	313	289	400		
Value	$150,000	$157,500	$12,000	$45,000	$2,925	$1,878	$3,468	$60,000	$432,771	31.5
Per cent of company's electric appliance sales	34.7	36.4	2.8	10.4	0.6	0.4	0.8	13.9		
Grand total	5,205	9,295	187	11,620	4,100	2,115	1,331	634		
Value—all dealers	$650,125	$487,452	$28,050	$69,720	$18,449	$12,590	$14,972	$95,100	$1,376,458	100.0
Per cent of total appliance sales	47.4	35.4	2.0	5.1	1.3	0.9	1.1	6.8	100.0	

department stores, with their superior buying power, their more thorough and effective advertising and the crowds which naturally pass through them daily, are enabled, if they so desire, to undersell other competitors.

CENTRAL-STATION COMPANY

Only within the last two years has the central-station company here resumed the merchandising of appliances. During and for some time after the war period this had been discontinued. The company has no outside salesmen working, with the exception of those supplied by manufacturers under resale contracts. It has a most attractive salesroom which is well equipped for demonstration purposes, and the salespeople are very attentive and courteous. The company plans to increase its merchandising activities by the addition of a crew of outside men, if high-caliber salesmen can be found. Appliances are sold on the deferred-payment plan, and a very considerable amount of newspaper advertising is carried on. Some complaints were made against the company offering special prices. Upon investigation, however, this was proved to be confined principally to electric flatirons and specials on toasters, and in the case of the flatirons it included a special offer whereby an ironing board was given away as a premium. Although the company aims to make its merchandise department self-supporting, it is conducted primarily with the object of increasing customers' consumption. The manager of this department was frank enough to admit that accounts were kept in such a manner that it was not possible to determine whether a profit was being made.

The vice-president and general manager of the central-station company was very emphatic in his declaration that the company would continue in the merchandising game, and he did not foresee any possibility of its retiring from the business. He criticised the attitude of some contractors and dealers who believe that jobbers and manufacturers should refuse to sell standard lines to drug and department stores. Where such a policy is in effect it tends to cause such stores to sell cheap, inferior products, which gives the business a bad name and in general demoralizes any efforts to insure a high standard of appliances being sold in a given city. The central-station company, he said, should not attempt to corner the appliance situation in a city, but should pursue an aggressive policy in order to stimulate other merchants to greater activity.

Contractors as an outlet for electric appliances and the electrical stores have proved, he said, to be most unstable and uncertain, and the casualties have been comparatively high. Factory branch stores or specialty stores which have concentrated their principal sales efforts on one or two appliances, with the smaller ones as a supplementary line, have been the most successful. What success they have enjoyed has been due largely to intensive sales methods. In this manager's opinion, all legitimate outlets should be encouraged to increase their sales, and if the policy of free trade is adopted, the question of inferior appliances will soon take care of itself.

CONCLUSIONS

The total sales of appliances considered in the survey of this city amount to $1,376,458 annually. Of this total hardware stores sell 7.6 per cent, department stores 8.4 per cent, contractor-dealers, factory branches and specialty stores 52.5 per cent and the central-station company 31.5 per cent.

There is a noticeable changing of attitude toward the appliance business among the smaller stores and dealers. A movement is under way among contractor-dealers and some of the factory branch stores to form what might be termed an electrical center. Already about half a dozen or so of these have located in a section of the business district which lies from three to five blocks away from the main shopping center. The main office and salesrooms of the central-station company is in this section but lies closer to the shopping center, having the best location. Many of the factory branch stores will not consider moving their locations but prefer to remain where they are now. It is difficult to see how dealers who are moving away from the busiest part of town will increase their business. It looks to be the forerunner of their retirement from the appliance business. Those dealers who have factory branch representation will probably continue in the business with a crew of outside salesmen, but will obtain very little business from voluntary visits to their stores. It appears inevitable that the number of contractor-dealers selling electrical merchandise must decrease, and some of the electric specialty stores are finding it difficult to keep up with expenses.

The department and hardware stores, with their widely diversified lines of merchandise and other natural advantages, show a decided tendency to increase their electric appliance activities. None of these will modify or slacken their efforts in this direction.

The central-station company, having but recently re-entered the merchandising field, is preparing to put additional effort into its sales.

FUTURE TREND

The indications are that both department stores and hardware stores will become more important factors as outlets for electrical merchandise. The contractor-dealer is rapidly retiring from the field, and some of the electrical shops and specialty stores show similar indications. Some of these latter will no doubt retire from the field. How far this will go it is difficult to say, but it seems certain that their sales of smaller appliances will soon be almost negligible. Their principal means of support comes from the sale of the larger devices—that is, washers and cleaners—very little attention being paid to the other devices.

The central-station company will probably not sell as large a volume of the larger devices proportionately, but will increase its sales of the small heating devices because of their energy consumption value.

Considering these facts, it appears probable that at the end of three years the following percentages will represent the distribution of sales among the four different outlets: Hardware stores, 10 per cent; department stores, 15 per cent; dealers and branch stores, 40 per cent; central-station company, 35 per cent.

It may appear at first glance that the percentage for department stores is too low, but it must be remembered that but one of the principal stores is showing any great activity, and the same is true of hardware stores. The fact that a number of dealers have already retired from merchandising and that some of the dealers and specialty stores are at present showing symptoms of retirement indicates that there is on the part of the public a definite trend away from buying at these stores. The central-station company's policy of increased merchandising activity will put it in a position to hold its own and in all probability increase its proportion of the total volume of sales.

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Power-Factor Clauses in Contracts

To the Editors of the ELECTRICAL WORLD:

On page 898 of the ELECTRICAL WORLD, issue of Nov. 3, there is an editorial entitled "What Is the Basis of a Power-Factor Solution?" This editorial refers to the application of a penalty or bonus on the bill, which penalty or bonus varies with the customer's power factor.

It is my opinion that this particular way of thinking of the so-called power-factor difficulty is one of the fundamental reasons why the solution of the difficulty has been so long delayed. Would not the idea of a so-called power-factor clause be more acceptable if we did not think in terms of penalties but thought in terms of the customer paying for what he gets? When we buy a reel of wire we pay for the wire and not for the reel. The wire manufacturer does not sell us the wire and make a penalty of so many dollars for the reels. When machinery is bought it is quite customary to pay an additional charge for crating and hauling. This is not, however, looked on as a penalty.

Perhaps the illustration would be somewhat better if it were considered that the cost of furnishing the reels, the cost of delivering reels to the customer and the cost of returning the reels would correspond to the cost of supplying and delivering reactive amperes. However, if the customer supplied the reels to the manufacturer and paid all handling charges on the reels, he would not, then, be charged any amount for reels. This would correspond to the customer bringing his load up to 100 per cent power factor. In the case of the reels of wire it would reduce the manufacturer's total bill to the customer. In the case of the central-station company it would make it possible for the central-station company to make a lower charge to the customer.

I do not think that a rate which had a relation to the power factor could be looked on as carrying a penalty or a bonus any more than the reel for wire and the crate charges are looked on as penalties. The rate should be such that the customer pays for what he gets. Again, would not the so-called power-factor clause be more acceptable if it was not a power-factor clause at all, but a demand charge, varying with the total kva. supplied to the customer to fill the requirements of his motors?

It is a difficult job to explain a rate which makes an energy charge for kilowatts, a demand charge for kilowatts, and then a variation of the demand charge, depending upon the power factor. It is not particularly distasteful, however, to explain a rate made up of an energy charge based on kilowatts and a demand charge based on the volt-amperes which the customer draws from the central-station lines. It is not difficult to explain to the general business man that the cost of supplying his service varies, in general, with the amount of energy which he draws from the system and with the amount of his volt-ampere load. As one of the speakers at the N. E. L. A. convention in Atlantic City put it, the customer using an alternating-current motor should be required to pay for the exciting current of his motors, just as he would have to pay for exciting current if he were operating direct-current motors.

Can we not, therefore, stop referring to power-factor clauses and to penalties and bonuses and refer to a kva. demand and charges based on the kva. demand?

E. P. PECK,
General Superintendent Electrical Department.
Utica Gas & Electric Company, Utica, N. Y.

[The editorial under discussion tried to point out that the general trend of all studies looking toward an adequate measuring and rate plan was toward a rate based upon kva. demand and kilowatt-hour consumption. It will be recognized, however, by electrical engineers and central-station executives that this system is merely the best solution to the problem of charging for the service given, and that, when reduced to its elements, it does involve a penalty for low power factor or a bonus for high power factor. Mr. Peck is entirely sound in his contention for a simple rate to the customer. Of all definite plans proposed the one involving kva. demand and kilowatt-hour consumption meets with most approval and resists most criticisms. When it is made practicable from the standpoint of instrumentation it will doubtless be generally adopted and "bonus" and "penalty" rates discarded.—EDITORS.

Philadelphia's "Home Electric" Demonstration Has Encouraging Aftermath

To the Editors of the ELECTRICAL WORLD:

I have been deeply interested in reading the editorial in your Nov. 17 issue entitled "Kindle the Spark" and thoroughly agree with the thought that any endeavor to promote the electrical idea in a community must be supported by a co-operative effort of the industry and particularly of the central-station company.

I am speaking from recent experience, having had the privilege of heading the general committee that recently promoted the "home electric" in Philadelphia. There was no comprehensive organization to push forward the home or any other activity when the matter first came under consideration, and the central-station company therefore, could not commit itself to such a project; but the industry in Philadelphia overcame this obstacle by contributing funds and workers to such an extent that $12,000 was placed in the hands of the general committee, and of this amount the central station contributed nearly one-half.

The result of this co-operative effort was Philadelphia's first "home electric"—a home that was without parallel in its completeness and the manner in which is was presented to its guests, who numbered nearly 55,000; but even these amazing results were secondary to the effect it had on the electrical industry in our city. Within less than a month after the closing of the home a campaign lasting six days was put on to obtain more members for an electrical trade association, with the result that more than 250 new members were secured, giving this organization, with its old members, a representation of 400 to carry on the cause of spreading the electrical idea among the consumers.

The point I wish to stress is that, though the inspiration for such movements as the "home electric" may be contributed by an individual, it is impossible to push such a project to successful completion without real co-operation from the trade and without the sanction of the central station. This we have had in Philadelphia to an unusual degree. I look back on our successful campaign and appreciate how futile would be the effort of any individual or small group, and I feel that Philadelphia should be congratulated on its success in welding the branches of the electrical fraternity.

DAVID C. BIRDSELL,
Chairman Associated Electrical Industries of Philadelphia.
Philadelphia, Pa.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Control and Pipe Room Layout of the Delaware Station

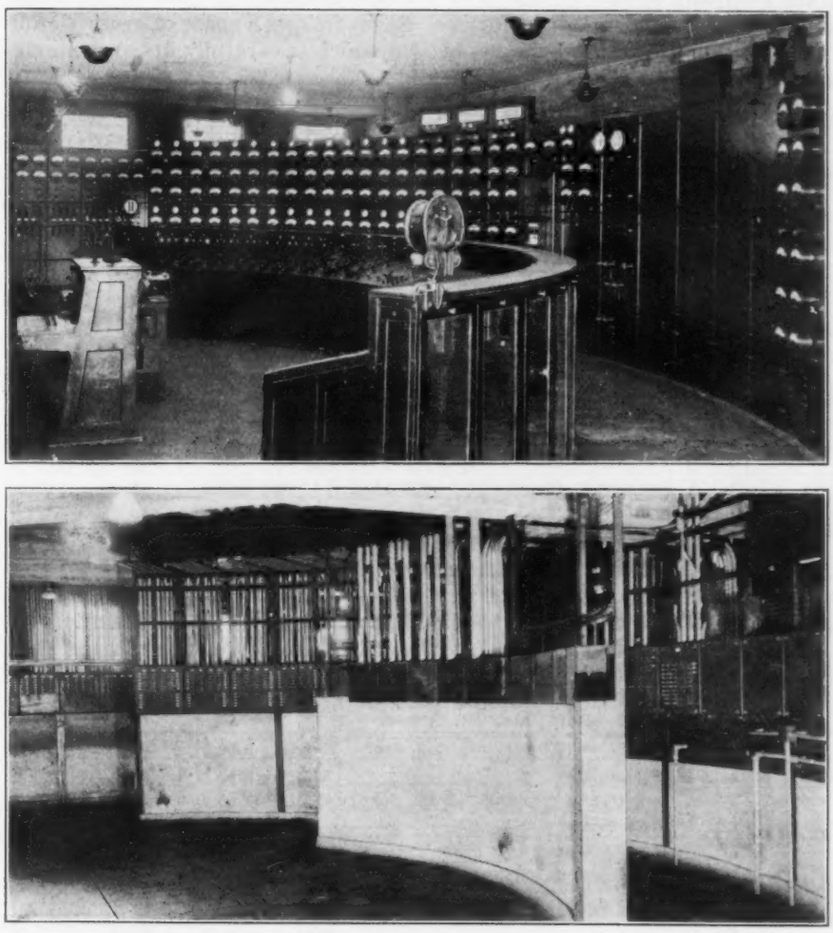
By R. A. Hentz
Philadelphia Electric Company, Philadelphia, Pa.

THE operating room, the nerve center of every generating plant, is always of interest and importance. The operating room of the 200,000 kva. Delaware generating station of the Philadelphia Electric Company is shown in the accompanying illustration. Here concentration of control has been adopted to a marked degree, for in addition to the control of the six 33,333-kva. generators and the fifty-six outgoing 13,200-volt feeders, control of the 2,400-volt station auxiliary supply and of the 250-volt direct-current power and emergency excitation bus is also installed.

The necessity of safely installing the multiplicity of control wiring in such a comparatively small area led to the development of the pipe room directly under the operating room. An inspection of the illustration shows the neat arrangement under the bench board. Everything is visible, accessible and well illuminated.

With this room as a distributing point for all of the control, signal and secondary wiring, it is possible to avoid the congestion of wires often seen in the back of switchboards where the wiring coming from pipe in the floor is spliced directly to that on the back of the panels. Instead, these wires extend straight through the pipe in the floor to sheet-iron boxes placed at the ceiling of the pipe room. These boxes are partitioned so as to confine the damage should breakdown or fire occur on any of the leads. To the pipe room is brought all of the conduit from oil switches, instrument transformers, etc., not only from the main switchhouse and station auxiliary bus rooms, but also from the turbine hall and boiler house. The secondaries of the instrument transformers are wired to cut-out panels, solid links being used in the secondaries from current transformers and fuses in those from potential transformers. This forms a convenient point for testing instrument circuits and the location and elimination of trouble. Similarly, control circuits are sectionalized through fused knife switches which serve the same purpose. It is possible to find a ground on a control wire, for example, in a very short time, while without these sectional switches many hours of search would be required.

A further important advantage of the pipe room is the ease with which additions to the operating room equipment can be made. To this end a large amount of spare conduit is extended to it from all parts of the station. In the switch-house wall a spare pipe is run for each generator and feeder section, from the top or bus galley to the basement with an extension into the pipe room, thus providing wiring for any additional equipment that may be required in connection with the 13,200-volt installation that should be controlled from the operating room. Extensions from these spare pipe outlets to any other point in the operating room where new switchboard panels might be installed can readily be made in the pipe room.



ADVANTAGE OF PIPE ROOM IS THE EASE WITH WHICH ADDITIONS TO THE OPERATING ROOM EQUIPMENT CAN BE MADE

The above principles of design are not entirely new at this plant, they having been incorporated first in the company's Chester station, placed in

operation in 1918, and subsequently in the reconstruction of its older Schuylkill station. However, the greater size of the Delaware station, with the consequent greater amount of control, makes this installation of particular interest.

Estimating Electrical Construction Work

BY R. L. KIRK

Engineering Department, Duquesne Light Company, Pittsburgh.

AN UNUSUAL method of estimating the cost of new construction work which consists of subdividing the projects into its component units and carefully estimating the cost of each on a specially prepared form has been developed by the engineering department of the Duquesne Light Company.

With this method a transformer and switching station would be resolved into the following units: 22,000-volt line circuit, 22,000-volt transformer circuit, 4,000-volt transformer circuit, 4,000-volt lighting circuit, 4,000-volt power circuit, street-lighting circuit, station service circuit, general equipment, etc. Each of these units would then be carefully analyzed and estimated on the standard estimate sheet and properly summarized into the total estimated cost of the new station. The estimate sheets, printed in tablet form on thin paper to allow blueprinting, a sample of which is shown herewith, have several unique features which are best explained by the simple estimate of a 2,300-volt, single-phase regulated lighting feeder circuit.

The heading is prepared to suit the particular requirements of the office routine of the department. Below follows a space of cross-section on which is carefully drawn a single-line wiring diagram of the circuit or unit under consideration. Care is taken to see that every major piece of equipment required throughout the entire circuit is indicated on the diagram. Only minor articles that may properly be covered by a miscellaneous item are omitted. Note that even a line representing control conduit ties the instrument transformers to their proper instruments. This is of material assistance in checking the estimate as to proper relay and instrument connections.

To each article an item number is given, or preferably an item letter to prevent confusion between the item and the number required, and the article is listed below with proper description and cost.

The symbol column has proved a source of great advantage. It requires only a second or so to draw in a small symbol which brings quickly and clearly to mind the various items called for in the estimate. Furthermore, in checking or listing similar pieces of equipment throughout an estimate of some ten or twenty pages, it saves considerable time in locating the desired equipment, as the eye can quickly and easily run down the symbol column and locate the desired articles without having to read and assimilate all the written description. These symbols are likewise employed on the standard bill of material forms used by the company.

After the various circuits and general equipment have been analyzed and estimated, a summary sheet is prepared showing the number and total cost of the various units required in the complete project. Blueprints are then obtained for distribution to the proper authorities. An extra blue-print may be filed in the estimate file and indexed under the type of circuit. These various estimates, checked from time to time against actual construction costs, provide a valuable record for quickly and accurately preparing estimates of new work using more or less standard circuits.

A complete and up-to-date cost-finding system is likewise installed so that the actual cost of all equipment going into new combinations may be quickly and easily determined.

One of the greatest advantages of this system, outside of the accuracy obtained by the analysis of circuits into units, is the fact that the estimate sheets in themselves tell the complete story of the new design. Should the job be transferred from

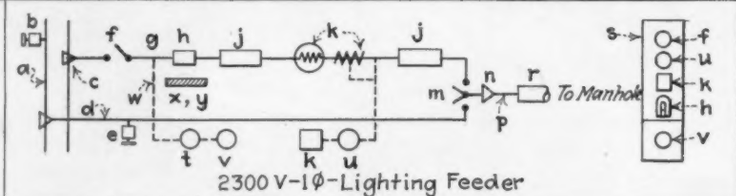
ESTIMATE SHEET

Page 6 of 105

Eng. Dept. Duquesne Light Co. I. D. O. 495

General Div. Sub Station. A. F. I. 2475 C. O. 5313

COMPILED CHECKED APPROVED DATE 9/10/'25 DWG.



2300 V-1Ø-Lighting Feeder

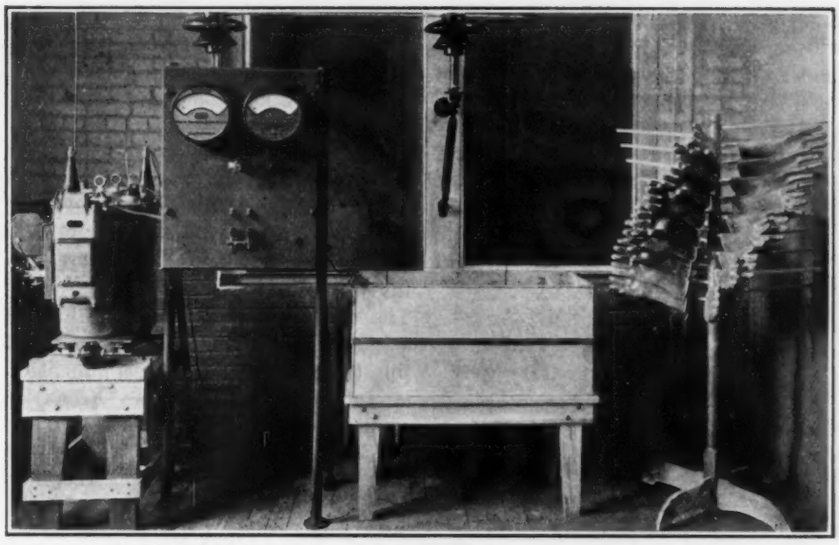
	Item No.	Symbol	Description of Equipment	No. Req'd	Estimated Cost Unit	Estimated Cost Total	Remarks
	a		3"x1/4" Copper bar	15'	.60	9	
	b		2300 V. Bus support-1-3"x1/4" bar	4	4.50	18	
	c		Bus clamp-1-3"x1/4" bar & terminal	4	2.00	8	
	d		500,000 cir. mil.- 2300 V. wire	150'	.60	90	
	e		2300 V. Insulator 1-500,000 CM.	4	3.50	14	
	f		600 A-2300 V S.P.S.T. disconnect	3	25.00	75	
	g		600/5 A - Type KA Current Transf.	1	35.00	35	
○	h		600 A-15000V.-3 pole manuel-B13,O.C.B.	1	550.00	550	
	j		2" Fiber duct	80'	.20	16	
	k		400 A.-10% Regulator, complete	1	1500.	1500	
	m		600 A.-2300 V. Selector Switch	3	35.00	105	
	n		4 Cond. 350,000 cir. mil. Pothead	1	40.00	40	
	p		4 Cond. 350,000 cir. mil. L.C. Cable	100'	2.00	200	
	r		4" Iron pipe	90'	.90	81	
	s		65"x24"x2" + 25"x24"x2" Panel	1	35.00	35	
	t	Ⓐ	500 A Ammeter	1	25.00	25	
	u	Ⓥ	150 V Voltmeter.	1	25.00	25	
	v		4-12 A Type CO Relay	1	35.00	35	
	w		1 1/4" Conduit & control wire			20	
	x		Iron work	300#	.10	30	
	y		1/4" Asbestos	50 sq. ft.	.20	10	
			Miscellaneous			25	
			Labor at 20%			600	
						3544	
○			Engineering & Contingencies at 10%			356	
			TOTAL				$3,900

ACCURACY IN ESTIMATING CONSTRUCTION COSTS OBTAINED BY DIVIDING CIRCUITS INTO UNITS

one engineer to another to follow through to completion practically all the necessary details are clearly presented on these forms. Furthermore, should the estimate cover a rush job, a blanket order for all material can be easily prepared and blueprint copies of the estimate sheets furnished the drafting room for its information in working up the necessary drawings. This method can also be used to advantage when either financial limitations or a poor supply of men makes it necessary to employ rather inexperienced engineers, as it requires a careful analysis of the job presented in a manner easily checked by a more experienced man. This eliminates to a certain extent the possible embarrassment resulting from the necessity of obtaining an additional appropriation for under-estimated work.

Rubber Gloves Tested for 10,000 Volts

TESTS on rubber gloves used by the Consumers' Power Company, Jackson, Mich., must withstand 10,000 volts applied for three minutes with a leakage current not exceeding 10 milliamperes, according to the report by James Kelly, chairman of the sub-committee on testing rubber gloves, central safety committee. The testing equipment consists of a special transformer with an induction regulator which permits a voltage variation up to 30,000 volts. On the high-tension side there is an adjustable spark gap, while for protection on the primary circuit an automatic circuit breaker is used. The primary circuit has multiple series windings for 200 volts and 400 volts, which permits the operation of the transformer through the regulator from the 110-volt or 220-volt supply. A separate potential winding is provided so that the voltage may be read accurately regardless of the load or power factor on the main winding.



COMPLETE TESTING EQUIPMENT, SHOWING THE ARRANGEMENT OF THE REGULATOR, TRANSFORMER AND PANELBOARD

One secondary terminal is connected to the inside of the glove under test and the other terminal to the metal water tank. The spark gap is set for the desired maximum voltage and connected across the high-tension terminals. The milliammeter is connected in series with the lead to the water tank in order to measure the current leakage. This lead of the transformer is grounded. The milliammeter is shunted by a switch which closes with a spring so that it can be held open only long enough to take readings.

When testing a glove it is filled with water to within 2 in. of the top and then hung on the ungrounded high-voltage terminal with a chain that goes down into the fingers of the glove and is then immersed in the water of the tank. The set is cut in a zero voltage and the potential slowly raised by means of the regulator to 10,000 volts. A reading of the milliammeter is then taken. If this is in excess of 10 milliamperes. the glove is discarded. If it is 10 milliamperes or less, the voltage is applied for three minutes and another reading taken. Should the reading still remain 10 milliamperes or less, the glove is stamped with the duration and voltage of the test and placed in stock. Special tests have been made by subjecting gloves to 20,000 volts without a breakdown or excessive leakage. But in general it is held that the 10,000-volt test fills every requirement.

Rubber gloves are tested every sixty days. As a pair of gloves first comes to the laboratory it receives a permanent number and the result of the test is stamped on it. This information is also entered on a card, which is filed, so that when the gloves are next due for test a post card notice asking for their return

JAN. | FEB. | MAR. | APR. | MAY | JUNE | JULY | AUG. | SEPT. | OCT. | NOV. | DEC. | NO.

APPARATUS

CONSUMERS POWER CO. ELECTRICAL LABORATORY JACKSON, MICH.

MAKE DATE REC'D. HAND R OR L NEW OLD

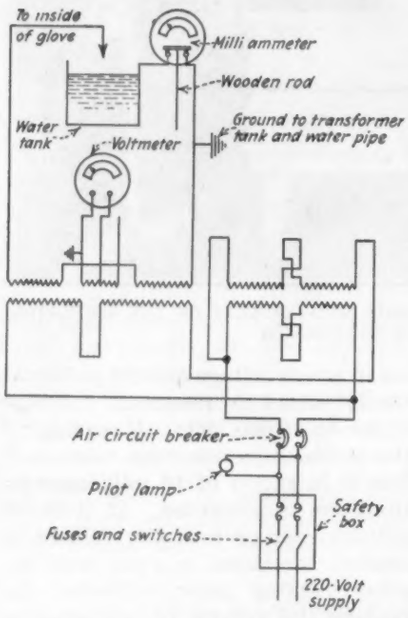
SHIPPED TO DATE

TESTED				
DATE	VOLTS	MILLIAMPS	TIME	CONDITION

THIS CARD IS USED AT THE ELECTRICAL LABORATORY AND CONTAINS ALL THE TEST DATA ON GLOVES

can be sent to the holder of the gloves together with a pair of recently tested gloves. The result of each test is entered on a record card so that a complete record of every pair of gloves is kept from its first receipt at the laboratory until the time it is discarded.

Gloves failing to measure up to



INTERNAL CONNECTIONS OF THE REGULATOR AND TRANSFORMER

the standard of 10,000 volts for three minutes with a leakage not exceeding 10 milliamperes are stamped "condemned" and turned over to the gas department for use in washing meters, or to the construction department for work around hydraulic plants where it is necessary for the men to put their hands into cold water. No glove marked "condemned" must ever be used for protection from electrical shocks even on the lowest voltages.

Condenser-Tube Failures

THE two general characters of condenser-tube failures, according to W. R. Webster, vice-president of the Bridgeport Brass Company, who spoke before a recent Metropolitan Section meeting of the A. S. M. E., are spontaneous longitudinal splitting of the tube, known as season cracking, and the corrosive action on the tubes of the cooling water and substances carried in with this water.

Sufficient facts have not been established on the basis of scientific procedure to make it at this time possible for any one to predict with certainty, within very broad limits, that any particular lot of tubes will endure under average service conditions in a measurably superior degree from other tubes differing from them in material respects.

Tube failures in a condenser are usually such that the difference in crystalline structure is not indicated as a clue to the trouble. Air bubbles have been noted as being exceedingly active in causing corrosion. The characteristic of this failure is a bright surface along the inside of the tube. Plug-type dezincification is indicated by circular areas of small size eaten into the tube.

Failures in which the wall of the tube is dissolved in an irregular manner, frequently in the region of inlet areas, have been proved to be due to the presence of air in the condensing water. This leaves a bright surface. Soaking the tubes in quiescent sea water at 40 deg. C. for about a week forms a protective coating, in many cases of much benefit.

Among preventive measures frequent cleaning of tubes and also the use of an iron protective plate properly attached to the tube sheet are recommended. The omission of the final pickling operation in the manufacture of tubing appears worthy of trial, as this will leave the outside scale as a protective coating.

In the discussion that followed it was brought out that during the last twenty years there had been no very definite conclusions produced in regard to the causes of condenser-tube failures.

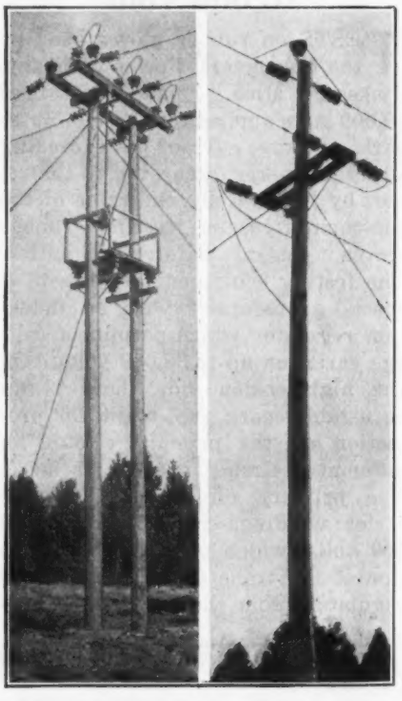
E. B. Ricketts brought out the fact that air bubbles had been specially serious, producing a deterioration that softened the metal so that it could often be cut with a knife.

The conflicting character of tube corrosion was strongly emphasized by Willis Lawrence. In one installation two condensers served the same turbine. In one condenser tubes in the upper part corroded badly, and in the second one tubes in the lower part were corroded, although both were made by the same manufacturer. In one case forty tubes were plugged and in the second about seven hundred during the same period of service. It had happened in one condenser that bad tubes were well distributed and in another case that there were a large number bad in one pocket. After twenty-one years of operation the causes are hazy in character.

Further discussion emphasized that the water compartments were not designed for good stream flow. Water in turning sharp corners tends to form air pockets, and under such circumstances corrosion is inclined to be rapid. In some cases air may be injected, and it often stays for a considerable period in one location in the tube before being absorbed by the circulating water. Dezincification is the principal trouble.

Mr. Price of the Scovil Manufacturing Company said that the Bureau of Mines considered that grain-crystal sizes were vitally connected with tube corrosion. Fine grain showed considerably less corrosion than coarse grain. In low-temperature annealing, such as 260 deg. C. for one hour, there was no evidence of recrystallization, yet the strains were relieved.

Line Construction for 60,000 Volts



TYPICAL construction on the 60-kv. line crossing the Sierra Nevada Mountains (Cal.), recently built by the Pacific Gas & Electric Company, is here shown. The line crosses the summit at an elevation of 7,300 ft. and owing to the heavy winter storms extra heavy construction was employed. The conductors are No. 2 stranded copper supported on 70,000-volt pin-type insulators. Spans at the higher altitudes are 150 ft., while at the lower levels this is lengthened to 200 ft. Class A, 45-ft. red cedar poles were used. The view on the left shows a 60-kv. pole top switch, while that on the right shows a typical dead end structure.

Reducing Distribution System Losses*

BY D. M. BUNN
Northern States Power Company, Minneapolis

IN LAYING out a distribution system one should study the present and ultimate requirements of the territory to be served and not make the mistake of putting up small copper. Small copper means excessive distribution losses as the load increases. In observing a number of distribution systems I have noted in every case where the practice of putting up big copper and keeping the number of transformers to a minimum and loaded as nearly as possible to full capacity is followed that the general losses have been 12 to 15 per cent. Those who have made no attempt to rebuild or to study the distribution systems as their loads increased, but have just added equipment from time to time and allowed transformers to be connected in a haphazard way, have high losses—18, 20 and 25 per cent.

Some time ago a study was made of the actual secondary losses on two circuits about three blocks long, parallel to each other, with a total of ninety meters connected. Each secondary circuit was supplied by a 5-kva. transformer tapped in at the end of each circuit. The secondaries were made up of two No. 8 copper wires. Before the test was started all house meters were adjusted to be as nearly accurate as possible. A meter was installed at each transformer to record energy input to the secondary circuit. To avoid error in reading meters the two circuits were killed long enough to read all meters and service was then restored. The tests ran for a period of twenty-one days. The power was shut off and all meter readings were again taken, with the following results:

Total input to meters at transformers, kw.	1,074
Total output of residence meters, kw.	932
Loss in meter shunts, kw.	60
Line loss, kw.	81
Line loss, per cent	7.6

It is evident that 7.6 per cent is too high for secondary losses. It was decided to rebuild the secondaries and complete them as a ring. Three wires (two No. 6 for the outside and one No. 8 for the neutral) were used, and the location of one 5-kva. transformer was changed to the far side of the ring. The next test showed the losses practically cut in half as follows:

Total input of meters at transformers, kw.	979
Total output of residence meters, kw.	768
Losses in meter shunts, kw.	68
Line loss, kw.	43
Line loss, per cent	4.4

Another way to reduce distribution losses is to correct poor power factor. I have had opportunity to observe static condenser installations in operation for power-factor correction in a number of industrial plants. In a manufacturing plant before correction was applied the energy consumption per unit of product was 0.89 kw.-hr., and for the same product after correction it was only 0.55 kw.-hr. This is a saving of about 30 per cent in consumption of energy in addition to improvement in power factor. Attention was called most forcibly to the installation in a large steel rolling mill. The power factor on this plant was 65 per cent, and it was necessary to keep two banks of transformers of 1,250 kva. each in service to carry a load of 1,518 kw. to prevent the transformer temperatures going beyond the danger point. Before the static condenser was installed the customer's bill for one month was:

Measured demand, kw.	1,518
Average power factor, per cent	65
Standard power factor, per cent	80
Kva. billed	1,859

With two 300-kva. static condensers installed the customer was able to discontinue the use of one bank of transformers of 1,250 kva. and carry the load on one bank. The bill for the following month shows:

Measured demand, kw.	1,518
Average power factor, per cent	93
Standard power factor, per cent	80
Kw. billed	1,294

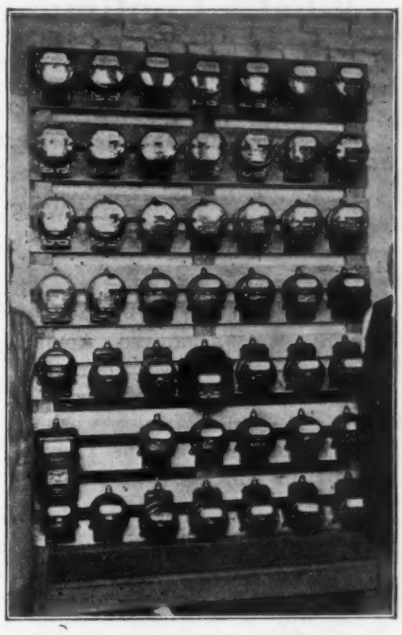
or 14.7 per cent less than the measured demand, on account of the high power factor. By discontinuing the use of one bank of transformers and improving the power factor from 65 per cent to 93 per cent, the customer's saving for one month amounted to $956 or about 9.6 per cent of the cost of the static condenser installation.

*Excerpt from paper presented before the North Central Division, N. E. L. A., Minneapolis, June 20-22, 1923.

Meter Testing Handled by Substation Operator

BY J. W. W. WALKER
Operating Superintendent Traction Light & Power Company, Anderson, Ind.

IN SMALL organizations which do not warrant the expenditure necessitated by a separate meter department much time and money is lost unless definite regulations are laid down regarding the maintenance and inspection of meters. The Traction Light & Power Company at Anderson, Ind., is using a system which has worked out very favorably since its installation in May, 1922. On that date the Alexandria substation, which lies northward of Anderson about 15 miles, was designated as the electrical testing laboratory of the system. This substation was chosen because the operator had had previous experience in meter-testing work. It was also chosen because it was in the center of our transportation system, thereby affording excellent facilities for the rapid movement of meters.



SUBSTATION OPERATOR HANDLES METER TESTING BESIDES REGULAR DUTIES

A meter rack was then constructed on the substation wall as illustrated. By placing the incoming meters on this rack a visible check is obtained on the amount of work laid up ahead for testing. This neat arrangement also prevents the meters from being scattered or injured by careless handling. Once these meters are placed on this rack, they remain there throughout the entire time of testing, long leads being used to connect to the standard.

In place of a rotating standard a 5-amp., single phase watt-hour meter is employed. The face of this meter has been removed and the dial graduated into 100 equal spaces. Red index lines mark the allowable 4 per cent limits, making it easy for the tester to determine if a meter is running too fast or too slow.

Giving the substation operator work to do besides his regular tasks has also enabled the company to reward him for his superior qualifications without any seeming injustice to other substation operators. Such an opportunity is often desirable.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

What a Continuous Residence Survey Has Done

One of the Most Extensive Examples of Organized Personal Contact with the Public by a Central-Station Company—Its Effect on Public Relations

By Will H. Fischer
Manager Department of Greater Service, Southern California Edison Company, Los Angeles

THE department of greater service of the Southern California Edison Company was organized April 1, 1921, the announcement thereof being contained in a circular letter from S. M. Kennedy, vice-president. The fundamentals of the plan are quoted from this letter as follows:

The work of the men in the "department of greater service" in each district will be fourfold:

1. To inquire from each consumer whether or not the service supplied by the company is satisfactory in every respect. This refers not only to the physical service, but also to the consumer's relations with meter readers, collectors, troublemen, clerks, telephone operators and other employees of the company with whom he may come in contact.

2. To give consumers, where the information is needed or desired, details regarding rate schedules and methods of charging for service, the welfare work carried on by the company in behalf of its employees and the present and prospective development work which is being carried on for the benefit of the communities served, the idea being to create an interest in the company's affairs and to convey the thought that the work the company is doing is for the benefit of the territory supplied and that the more rapidly the company's business grows and develops the more rapidly will southern California progress in its onward march.

3. To ascertain the mental attitude of each consumer interviewed, the idea being to find out whether the consumer is (a) in accord with the company's operations and prospective development work, (b) whether the consumer is indifferent to what the company is doing, or (c) whether he is in any way antagonistic to the company.

4. Assuming that the conditions under (1), (2) and (3) are satisfactory, the representative of the "department of greater service" will explain to the consumer the company's plan for customer ownership and its desire that all consumers, if it be possible, should become personally interested in the company's operations, even if only to a minimum amount.

The department was organized prior to the transfer of the Edison company's Los Angeles distributing system to the Municipal Bureau of Power and Light. For this short time there were about forty men in the field, but upon the transfer of service within the city the staff was greatly reduced. During the month of December, 1922, the writer, under the direction of Mr. Kennedy, took charge of the department and reorganized the work.

Number of Men and Calls

At the present time there are fifteen "greater service" representatives in the field. Their salaries average $150 per month. In a few instances necessary transportation is provided for them. They are covering twenty-four of the company's districts, and each representative interviews eleven consumers per day, on the average, when working along ordinary "greater-service" lines. This means that when so employed these men average 286 interviews per month. All remediable complaints discovered by them receive immediate attention from district offices. Troubles arising from imaginary complaints and misunderstandings are tactfully overcome.

The actual number of ordinary "greater service" calls per month, however, does not correspond with the average of eleven, because "greater service" representatives are called upon for many additional duties, which necessarily reduce the time spent on calls. With one report for the month incomplete, it is indicated that to Sept. 30, 1923, "greater service" representatives made 107,247 effective "greater service" calls and turned in cards from which the records have been built up. In many instances more than one call has been made on the same person, although only one card has been turned in. Numerous calls are made, also, where the customers are not at home. However, the word is passed along by neighbors, and knowledge of the fact that a representative visits the neighborhood has a salutary effect.

In addition to their regular work, our "greater service" representatives are coming to be general utility assistants to our district managers in all matters of public relations. These men have built up a virtually complete list of all organizations in the territory they serve. These lists cover (1) churches and clergymen, (2) chambers of commerce and their presidents and secretaries, (3) women's clubs and their principal officers, (4) Rotary, Kiwanis, advertising and other lunch clubs and their principal officers, (5) parent-teachers' associations and their principal officers, (6) fraternal organizations and their principal officers, (7) newspapers and their editors, (8) miscellaneous organizations and their principal officers, (9) municipal and other public officers, and (10) other persons of prominence in a community.

Personal Contact

"Greater service" representatives are required to become personally acquainted with those in charge of all such organizations and are expected to see them casually or otherwise with at least reasonable frequency. Through these contacts a great deal of good is accomplished. Very frequently our representatives receive intimate reports, suggestions and advice from the officers of these various classes of organizations, and not infrequently they are enabled to offset movements or activities during their formative stages which might prove inimical to the interests of the company. In addition, these representatives maintain a close and sympathetic contact with all persons connected with our district organizations. This contact results in greater club activities, a keener per-

ception of the necessity for and value of courteous, prompt and efficient service, and a general toning up of the district personnel.

Sources of Information

In addition to the card report on each effective call, the "greater service" representatives submit weekly reports in narrative form, the first copy being forwarded to this office and a duplicate copy being submitted at the same time to the district manager. These reports supplement daily conferences with district managers. By constant suggestion and training we are developing our representatives into excellent reporters, so that at the beginning of each week we have a comprehensive picture of all developments which might be deemed of importance in connection with public relations. We expect in these reports a review of political, civic, industrial, social and commercial activities. These reports as a whole are summarized at this office, a copy being sent to the principal officers of the company as well as to district managers and greater service representatives. Thus the best points are circulated for general information. They also have considerable suggestive value.

As Advance Agents

Another activity required of "greater service" representatives is that they make engagements for the lecture entitled "The Romance of Electricity," which is delivered by our field superintendent of education, who is connected with this department, and also for the "Edison Road Show," which consists of a series of electrical demonstrations by three experts who likewise work under the direction of this department. Considerable time and energy are required in this connection, but the results from the lecture and the road show are so gratifying that we believe the effort to be worth while, even at the cost of some reduction of time spent on consumer calls.

Frequently our "greater service" representatives are called upon by district managers to execute missions where tact and diplomacy are required. Sometimes managers go so far as to intrust to them bills on which our collectors have been unable to make returns. It is a notable fact that they almost invariably succeed. Likewise they sell no small amount of stock. In case company officers are engaged to appear before organizations in our districts, the "greater service" representative in the particular district concerned cooperates with the district manager in making necessary arrangements and assuring the attendance of important persons.

This department has also organized what in our shop talk we term "the Orpheum circuit." Four teams, each consisting of three prominent Edison men, go out from time to time on schedule to appear before our clubs and discuss subjects of interest. At these meetings we attempt to secure the attendance not only of our employees but also of stockholders, friends and the general public. "Greater service" men assist actively in promoting these meetings.

Experience necessarily varies according to districts. Some districts are urban, some suburban and some rural. In the latter class of districts the "greater service" representative manages not only to maintain close contact with individual farmers but also to keep in touch with farm bureaus, irrigation districts and similar organizations. The problems dealt with by such a representative are essentially different from those encountered by one who works on house-to-house calls in closely built-up territory. It is necessary, therefore, that each representative should not only observe the general principles of the service but should also specialize his activities. A representative working in a strictly industrial district like Vernon, on the edge of Los Angeles, a representative in the city of Long Beach and a representative in Tulare County cannot be expected to tell the "greater service" story in just the same way. The end sought by each of them, however, is the same, and they are provided from time to time with booklets and other literature which they hand out at their discretion.

Caring for Trouble

With reference to results, it is, of course, impossible to give a measurement in dollars and cents. We know, however, that the efforts of our district managers to render first-class service to consumers are being efficiently supported. Our men frequently find cases of small troubles. They report on these, and the causes are eliminated. Sometimes they find serious troubles and these are likewise corrected. Sometimes they uncover instances where employees have failed to exercise the courtesy and tact required of them by the company. They not only iron out these irritations so far as consumers are concerned, but also endeavor, through the district manager, to bring about an improvement on the part of the employees. We know that in territory previously not covered there were frequent, although often unjustified, complaints to the Railroad Commission, and that after "greater service" representatives were assigned to such territory these complaints ceased.

Such contact between consumers and company offices is extremely important in that it converts potential enemies into active and enthusiastic friends and very often into substantial stockholders. We are conscious of the fact that while our standing in our territory has always been good, there is a constantly increasing number of persons willing and anxious to speak a good word for us and if necessary to defend us against attack. We are conscious of a much

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AT THE annual convention of the National Electric Light Association in New York last June Managing Director M. H. Aylesworth recommended that the member companies undertake a national survey of residence installations, and such a survey was authorized by the convention. Its purpose would be to carry a message of public relations to every household in the land that is a consumer of electricity to secure a census of residence load and automatically to enjoy the large sale of additional appliances that inevitably would result therefrom. The development of a definite program for this great survey of all cities has been undertaken co-operatively by the Public Relations and Commercial Sections of the N. E. L. E. sitting as a committee with the following membership: H. T. Sands, Boston, chairman Public Relations Section; N. T. Wilcox, Boston, chairman Commercial Section; A. C. Marshall, Detroit; M. S. Sloan, Brooklyn; Charles J. Russell, Philadelphia: E. L. Milliken, Woonsocket, R. I.; R. H. Tillman, Baltimore; G. E. Miller, Cleveland; Earl E. Whitehorne, commercial editor *Electrical World*, ex officio.

For the purpose of promoting a broader understanding of the opportunities in such a survey, as it may apply to an individual city, the *Electrical World* will publish hereafter from time to time the experience of central-station companies that have already conducted independent surveys. Here is obviously the best possible guide to follow as to both objective and method and the best indication of benefits which can be expected to result. One of the most extensive activities has been in Los Angeles, and the story of the manner in which this most successful survey has been conducted is here presented.

closer intimacy between the company and those it serves, and it is gratifying to realize that outside of the city of Los Angeles, which is the home of the Bureau of Power and Light, one practically never hears an unfriendly reference to the company itself, even from those who may personally be imbued with ideas in favor of public ownership.

It goes without saying that the executive officers of the company and the district managers have a quicker contact and more intelligent conception of what is going on in company territory. Lastly, there is an immense satisfaction in feeling that through the operation of the greater service system as devised by Mr. Kennedy we are not only holding the fort but gradually, and permanently, I think, "winning the public."

Utilities Should Study Relative Merits of Refrigerators

THE public utility is going to be the ice man in the next five to ten years by serving domestic refrigerators, declared A. D. McLay of the Detroit Edison Company at the convention of the Great Lakes Division of the N. E. L. A. recently. For this prophecy to come true it will have to give refrigerating service, he contended, and not merely power, since ice manufacturers are already alert to the competitive situation. Already $60,000,000 has been spent by manufacturers to develop household electric refrigerators. Hence every utility should post itself on the relative merits of these systems. At least five systems have been employed, namely, compression, absorption, vacuum, air and "vapair."

The most extensively used is the compression system, although Mr. McLay expressed the belief that the "vapair" system has wonderful possibilities because of its simplicity and efficiency. The chief troubles with the compression system are with the stuffing box, expansion valves and thermostats. Furthermore, the fractional-horsepower motors need improvement in efficiency and power factor, since these are both less than 50 per cent. If the industry insists on better motors, the manufacturers will provide them, the speaker asserted. The absorption system has very low efficiency, and the vacuum system is liable to leakage and requires large equipment.

City's Visitors Reminded of Electrical Conveniences

THE Pittsfield (Mass.) Electric Company welcomes arriving travelers to the Berkshire city by an attractive billboard display featuring the labor-saving attractions of electric service and appliances. The board faces the Union Station and reminds the visitor of the advantages of things electrical as soon as he sets foot in this home of electrical manufacturing and progressive electrical service.

Information Bureau Supplies Good-Will Advertisements

TO PROVIDE the utilities of the state with suitable advertising copy for their use in good-will publicity the Michigan Committee on Public Utility Information has prepared a series of advertisements dealing with business and problems of the central-station and other public utility companies. The first of the series, which will be sent out monthly, is based on the obligation of the utility to render efficient service at low cost.

Concerning Public Service

UTILITY SERVICE MUST BE ELASTIC

¶ Gas, Electric, Telephone and Railway Service must not only be adequate for all normal requirements and increases, but also it must be capable of great expansion on short notice or no notice whatever.

¶ When a convention or a football crowd invades your city any morning, hundreds and more often thousands of people must be fed and warmed, lighted and transported. No one ever makes advance reservations at the Gas, Electric, Telephone or Street Railway offices. The managements must be prepared —and they always are.

¶ This is a part of modern public service provided by efficient and forward looking operation.

(Insert Company Name)

SPECIMEN OF INFORMATION BUREAU'S GOOD-WILL COPY

The committee itself does not run any of the advertisements, simply supplying the copy set up in appropriate typographical form as shown in the accompanying illustration. The aim was to furnish copy for those companies which had no such facilities. It is expected that this service will be confined to good-will advertising and assist in balancing the campaigns of companies which now advertise only the merchandise side of the business.

What Other Companies Are Doing

Boston, Mass. — All previous records for installation orders completed during one month on the system of the Edison Electric Illuminating Company were broken during October, when 17,543 orders were put through, an increase of 5 per cent over September, 1923, and of 32 per cent over October, 1922. The record month figures mean the addition of 4,688 customers and 5,313 kw. in connected load. The total connected load of the system Nov. 1 was 521,977 kw., and the company's books listed 173,665 customers. The connected motor load of the system aggregates 211,119 hp. From Jan. 1 to Nov. 1 the number of meters in use on the system increased by 22,396, the total being 196,853.

Montpelier, Vt. — Preliminary surveys of the industrial lighting situation in the granite working plants of this district indicate that by applying modern methods of illumination many plants can be operated under conditions formerly causing a shutdown because of inability to observe color demarcations. W. S. Wallace, illuminating engineer for Charles H. Tenney & Company, Boston, operators of the Montpelier & Barre Light & Power Company, is making a thorough investigation of lighting conditions in the granite industry. It is expected that considerable off-peak lighting business may result.

Ashland, Wis.—The Lake Superior District Power Company announces that 100 per cent of its employees have purchased preferred stock of the company. The employees have been active in the sale of stock to customers, and thus investing their own funds in business has aided materially in convincing the public of the merit of the security.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

New Power Station at Belfast, Ireland.—The new plant of the Belfast Corporation's electricity supply has recently been placed in operation. At present the capacity of the station is 24,500 kw., with another 12,500-kw. unit on order. The station will have an ultimate capacity of 150,000 kw. Details are given of the building and foundations, fuel-handling system, boiler-room installation, turbine room and switchboard galleries. There are two 6,000-kw. and one 12,500-kw. unit installed.—*Engineer* (*England*), Oct. 19, 1923.

Water and Coal Supply of the Western Slope of the Southern Appalachian Mountains.—J. A. SWITZER and W. R. WOOLRICH.—The authors correlate the present knowledge of the water powers in this region, recording present status of the power industry and its changing aspects, studying the base-load steam plants and discussing the labor situation.—*Mechanical Engineering*, November, 1923.

Hydraulic Turbines and Centrifugal Pumps.—H. W. COULTAS.—The construction and application of characteristic curves of reaction and impulse turbines and of centrifugal pumps are investigated, both theoretically and graphically. Among the specific subjects covered are velocity heads, measurement of water flow, turbine output, etc. The manner of plotting data obtained from turbine tests so that it will be of the utmost value is discussed in detail.—*Beama* (*England*), November, 1923.

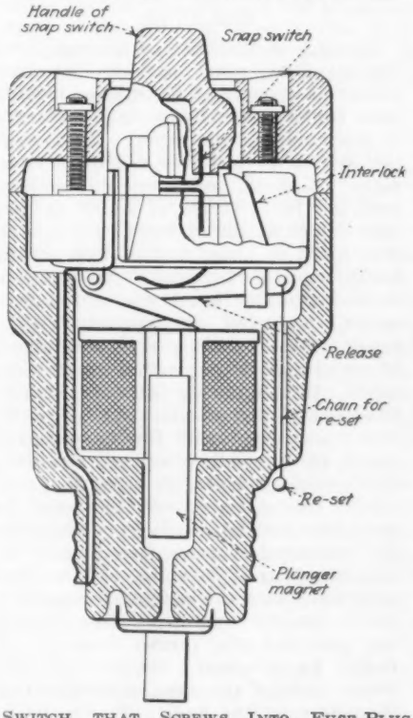
Remodeling Generating Plant.—H. W. BROOKS.—At a cost of $11 per kilowatt a plant installed twenty-two years ago has been modernized and all equipment put in such good operating condition as to effect a reduction in coal consumption of 20 per cent and a saving in maintenance at the same ratio. It is believed that the station will give effective service for ten to fifteen years, with the economies attained by the modern plant of equal size. The continued capacity of the station is about 18,000 kw. with 20,000 kw. to 22,000 kw. obtainable on the swings. Energy is generated three-phase, at 25 cycles and 2,300 volts.—*Power*, Oct. 30, 1923.

Developments of Southern California Edison Company.—H. L. DOOLITTLE.—The important water-power plants constructed by the Southern California Edison Company in the last two years are Kern River No. 3, Big Creek No. 8 and additional high-head impulse units in Big Creek plants Nos. 1 and 2, besides the new Big Creek No. 3 plant, which has recently been placed in operation. This paper, presented at the fall convention of the A. I. E. E., reviews some of the features of outstanding interest characterizing these plants.—*Journal of A. I. E. E.*, November, 1923.

Operating Results of Blackburn East Power Station.—Before actually giving the results from operation an outline is given of the equipment of this station, including the generating apparatus, boiler-room equipment, auxiliaries and switchboard-room layout. The stand-by or no-load losses in this 20,000-kw. plant are equivalent to a constant consumption of 18,600 lb. of coal per eight-hour shift. Neglecting the constant stand-by losses, every kilowatt-hour generated requires the expenditure of 1.54 lb. of coal and 11.77 lb. of steam. These figures indicate the coal and water consumption to which the station is approaching as the output increases. The evaporation corresponding to these consumptions is 7.647 lb. of water per pound of coal, which is equivalent to a limiting boiler efficiency of 80.6 per cent.—*Engineering* (*England*), Oct. 26, 1923.

Generation, Control, Switching and Protection

Small Automatic Switch.—W. KRÁSKA.—To replace the commonly used fuse an automatic switch has been developed that can be screwed into the socket of an ordinary fuse block. Its dimensions are about the same as those of a fuse plug. It consists of a small rotary snap switch with a magnetic release by means of a plunger magnet placed in the bottom part of the plug. A very essential detail is that the switch cannot be closed again after it has been opened by an overload. To reclose it the plug has to be first unscrewed and a small lever pulled down by hand. This prevents closing the switch upon a short circuit. The protective switch is rated at 15 amp., 250 volts.—*Elektrotechnische Zeitschrift*, Oct. 11, 1923.



SWITCH THAT SCREWS INTO FUSE-PLUG SOCKET GIVES ADEQUATE PROTECTION AGAINST OVERLOAD

Sensitive Tripping Mechanism for Oil Switches.—An oil-switch operating gear which does not necessitate the use of any independent relays or tripping circuit is described. A low fault current from an instrument transformer is sufficient to trip the switch direct without the use of any intermediate electrical links. The device incorporates a very interesting feature in that the energy required to open the switch is applied to it while it is being closed and is stored up ready to be disengaged when the trip coils operate. This feature of the device leads to the important condition that the work required from the trip coils is independent of the pressure on the catch holding the switch closed, which is determined by the pressure between the switch contacts and the adjustment generally. There is consequently no need for the tripping arrangements to be calibrated for any particular condition, and there is no danger that the switch will not trip even if it is badly adjusted.—*Engineering* (*England*), Oct. 26, 1923.

Transmission, Substations and Distribution

Group Operation of Systems Having Different Frequencies.—E. R. STAUFFACHER and H. J. BRIGGS.—An abstract of this paper, presented at the fall convention of the A. I. E. E., may be found in the Oct. 27, 1923, issue of the ELECTRICAL WORLD, page 863.—*Journal of A. I. E. E.*, November, 1923.

Electrical Apparatus for High-Tension Power Transmission.—S. Q. HAYES.—A descriptive article giving the latest developments of high-tension switching and transforming apparatus. Among the subjects discussed are high-tension transformers, bushings suitable for high-tension apparatus, oil circuit breakers for switching the high-tension circuits, disconnecting switches for isolating the oil breakers, lightning arresters for static protection and arrangements of transformers and switchgear suitable for high-tension installations.—*Electric Journal*, November, 1923.

Experiences with the Grounding Choke Coil.—P. VIDONNE.—The author gives a valuable account of the benefits which a French transmission system of medium operating voltage derived from the installation of a grounding choke coil of the Petersen type. The system comprises 93 miles of a single-circuit, three-phase line and 43 miles of a double-circuit three-phase overhead line, operating at 35,000 volts and 50 cycles. The transformers feeding the lines are

all connected "Y-Y." A dry-type transformer of 350-kva. rating, into the iron core of which a suitably dimensioned air gap has been introduced, is utilized as the grounding coil. The ground current of the two lines combined amounts to about 20 amp. at 20,400 volts. In case of a grounded phase the permanent ground current through the grounding coil is from 1 amp. to 1.5 amp. Even with a dissonance of as much as 20 per cent an arcing ground is relieved almost instantaneously. A small current transformer is placed between the Y-point of the coil and ground, energizing a signaling device whenever trouble arises. Particularly during storms, when branches of trees are often thrown across the lines, the protective apparatus functions frequently, without causing automatic breakers to open as was previously a common occurrence. Before the grounding coil was installed as many as twenty-five insulator flashovers occurred per month, a number which has now been reduced to a maximum of three. Transformer punctures have been completely eliminated. Telephonic communication over wires carried on the main transmission towers has not been affected.—*Revue Générale de l'Électricité*, Oct. 20, 1923.

Illumination

Lighting of Norfolk & Western Railroad Yards.—Recently the Norfolk & Western completed the installation of lights in fifteen of its yards. A system of flood lighting particularly suited to the requirements of classification yards has already proved a valuable aid and productive of increasing efficiency. Steel towers of Bates design fitted with a platform and railing at the top are used for supporting the lighting units. Each projector contains a 1,000-watt lamp properly ventilated. The effective ranges vary from 800 ft. to 1,600 ft. — *Railway Electric Engineer*, September, 1923.

Standards of Radiation Intensity.—For a number of years the Bureau of Standards has been investigating the instruments and methods used in radiometry, and during the past nine years it has provided investigators with standards of radiation intensity in absolute value. These radiation standards are of use to biologists, physiologists, psychologists and others, to standardize the light stimuli employed in their investigations. In this way the work throughout the country is becoming systematized and specified on a reproducible basis.—*Technical News Bureau No. 29 of the Bureau of Standards.*

Motors and Control

Measurement of the Quantity of Air Delivered by Ventilators and Compressors.—C. A. BERTELLA.—With a few formulas and many illustrations the author describes the apparatus to be employed to control exactly and rapidly the quantity of air delivered by ventilators and compressors. How the various measurements are to be made is shown, and practical data concerning laboratory experiences are given.—*Ingegneria*, September, 1923.

Electric Drive in the Printing of Newspapers.—CARL F. SCOTT.—The application of electricity in the production of the finished newspaper—that is, the actual printing—is outlined. The first part of the article is devoted to a detailed but brief historical review of the development of the modern types of newspaper printing presses, while the remainder describes the load characteristics of a press, the manner in which the electric drive is arranged to fulfill the requirements completely and the control equipment employed with modern printing presses. — *General Electric Review*, November, 1923.

Winding Electric Motors.—A. C. ROE.—The author describes steps in stubbing and connecting windings of two-phase and three-phase induction motors with an explanation of some two-voltage windings. The actual work which the repairman does with his hands and tools in making winding connections after he has checked up the diagrams and determined what connections to make is described.—*Industrial Engineer*, November, 1923.

Electrical Safety Inspection.—L. C. ILSLEY.—The author has written this paper especially for state mining inspectors, safety engineers of mining companies and others interested in electrical safety inspection in mines. It presents the important points that should be watched by inspectors and reviews the work of the Bureau of Mines in the testing of electrical apparatus or equipment to determine its permissibility for use in gaseous coal mines. The treatment of the subject is very comprehensive.—*Reports of Investigations, No. 2541, Bureau of Mines.*

Heat Applications and Material Handling

Stresses in Welded and Riveted Steel Tanks.—The work carried out last winter on stresses in welded and riveted steel tanks under hydrostatic pressure is reported in this paper. Four steel tanks, 4 ft. in diameter and 10 ft. long, made of $\frac{1}{16}$-in. mild-steel plates and designed for a stress of 16,000 lb. per square inch at 200 lb. working pressure, were used in these tests. Two of the tanks were butt-welded, one was lap-welded, and the fourth was of the ordinary lap-riveted construction. As a result of the analysis of the deformation and distribution of stress in these tanks, the following general conclusions seem warranted: (1) The commonly accepted theory for the design of tanks is, for all practical purposes, sufficiently accurate, provided the computed stresses are not influenced by secondary stresses. (2) For thin tanks the measured stresses, based upon the two-dimensional formula, are in close agreement with the design stresses computed by the usual pressure formulas, provided the former are not affected by secondary causes. This is borne out by the results obtained at the center of the end. (3) Secondary stresses resulting in high-stress intensity were caused by (a) faulty design of the attachment of the spherical end to the cylindrical shell, (b) non-conformity of the shell to an accurate circular section, and (c) discontinuities in the shell for the manhole and fittings. These may produce a possibly dangerous condition if they are near a welded or riveted joint or seam. (4) The stresses were increased by the presence of a seam.—*Technologic Paper No. 243 of the Bureau of Standards.*

Electrophysics, Electrochemistry and Batteries

Some Relations Between the Microstructure of Metal Surfaces and Electrodeposits Made Thereon.—A. K. GRAHAM. — The author discusses the influence of the structure of the base metal on electrodeposits. A distinction is made between primary influence, or true reproduction, and secondary influence, or the effect of this reproduction on the deposit at large. Where reproduction is obtained large crystals in the base metal produce the most marked secondary influence on the electrodeposit. Reproduction of the structure of both copper-base and brass-base metal, but not of nickel, was obtained in copper deposits. Results obtained with nickel deposits on both copper-base and nickel-base metal are uncertain owing to the difficulty experienced in attempting to reveal their structure upon etching.—*Paper presented before the American Electrochemical Society at Dayton, Ohio*, Sept. 27-29, 1923.

Traction

Concrete Poles for Railway Electrification.—Experiments carried on by the Cleveland Railway Company indicate that the original type of reinforced-concrete pole contained more material than was necessary to insure adequate strength. A series of tests were made to determine the relative value of different types of concrete poles for use in overhead construction on tangent track. The primary object of these investigations was to design a pole that would be adequate for this purpose. Detailed accounts are given of some of the more important tests that were conducted.—*Electric Railway Journal*, Nov. 10, 1923.

Telegraphy, Telephony, Radio and Signals

Modern Receiving Radio Stations.—UGO SORDINA.—A review of what has been done to improve the receiving part of a radio station. The most important requirements are discussed and atmospherical interferences are specially treated. The different systems of reception are also considered, and a survey of all the most important radio stations of the world is given. Many illustrations presenting a variety of circuit connections accompany this paper. —*Elettrotecnica*, Sept. 25, 1923.

Fire-Alarm Systems.—W. J. SMITH.—Several of the more important and most utilized fire-alarm systems are described and illustrated.—*Electrical Record*, October, 1923

New Books

Reviews of the Latest Contributions to
Technical, Industrial and Commercial Literature of Particular Interest
to Members of the Electrical Industry

English for Engineers

By S. A. Harbarger, Department of English, Ohio State University. First edition. New York: McGraw-Hill Book Company, Inc. 266 pages.

Primarily written to convince the engineering student of the importance of the English language as a tool of expression, this book contains many useful suggestions for the professional man. Letter writing, applications, wire communications, orders, the preparation of instructions, the practice of dictation, the preparation of abstracts, summaries, articles for technical journals and general professional writing are covered in a logical and workable manner. Especially comprehensive is a chapter on engineering reports, and the book is enriched by a short chapter on the value of engineering society meetings and by a large number of references to articles, books and editorials published since the war to stimulate interest and improve practice in writing by engineers. This bibliography is unusually comprehensive and suggestive. Some helpful thoughts on reading for general culture occupy a chapter of much practical value, and there is an excellent index.

The Outline of Radio

By John V. L. Hogan. New York: Little, Brown & Company. 256 pages, illustrated.

Here is a book for any one who is attracted by either the novelty or the present importance of radio and wants to know how it works. For those who have no scientific training it will have the appeal of an easy style and a beginning, under each topic, with facts and laws which are matters of daily experience to every one. Nor will they find it difficult to follow the author's explanations of the less familiar natural phenomena involved in the somewhat extended chain of transformations going to make up the complete radio message. Each of the links in this chain is taken up in its turn and its nature explained by analogy and comparison with other more familiar phenomena. So far back does the author go in some cases in his purpose to enable the uninitiated to pick up the thread that he occasionally approaches the metaphysical, as, for example, in his comments on the nature of intelligence, and that of the ether. The result, however, is altogether helpful to his constant purpose of a clear explanation.

To the scientist and engineer the book also makes its appeal by reason of its complete assembly of all the elements of the radio chain, and particularly by its presentation of the numerical limits of the various quantities involved and their peculiarities within the different ranges. The discussion of frequency is especially happy.

The easy style enlivens the historical review, as well as all that follows it, and a well-chosen series of diagrams also does much to help the unaccustomed reader on his way to an understanding of the nature of radio. Mr. Hogan reveals himself a good physicist and a good teacher. His book should prove a popular response to the present widespread demand for general knowledge of the nature and possibilities of radio.

Elements of Machine Design

By Dexter S. Kimball and John H. Barr. New York: John Wiley & Sons, Inc. 466 pages.

A thoroughly revised and enlarged second edition of this favorite textbook will be welcomed by engineers and engineering educators. The authors have rewritten and brought up to date the material in the early edition and have included a chapter on the balancing of machine parts. The book is really a dynamic textbook on mechanics directly applied to machines and machine parts. It presupposes a knowledge of mathematics and theoretical mechanics, and deals with the parts of machines, the energy changes, the resultant forces and the proportioning of the parts to withstand the forces. Gears, axles, screws, riveted fastenings, springs, tubes, sliding surfaces, rolling surfaces, lubrication, friction, efficiency and machine frames are some of the many details thoroughly treated. The new chapter on machine balancing will be very welcome, as this subject has long been neglected in textbooks.

Jahrbuch der Elektrotechnik

Edited by Dr. Karl Strecker. Munich and Berlin: R. Oldenburg. 233 pages.

The ninth annual edition of this yearbook gives a summary of progress in electrical engineering during 1920 by means of very brief references to the important articles in sixty German, Austrian, Swiss, French, English and American journals. The American publications include the ELECTRICAL WORLD, *Electric Railway Journal, Chemical and Metallurgical Engineering, General Electric Review, Bulletin of the Bureau of Standards, Physical Review,* and the journals of the American Institute of Electrical Engineers and the American Chemical Society. There are four general divisions, "Electromechanics," "Electrochemistry," "Communication" and "Measurements and Research." The material in each is very thoroughly classified, each section being handled by a specialist in that field.

P. H. DAGGETT.

Electrical Vibration Instruments

By A. E. Kennelly. New York: The Macmillan Company. 450 pages, illustrated.

This volume is one of the Engineering Science Series under the general editorial supervision of Profs. D. C. Jackson and E. R. Hedrick. It treats of the theory, design and testing of telephone receivers, oscillographs and vibration galvanometers. Fifteen chapters are devoted to the telephone, seven to the oscillograph and one to the galvanometer. The point of view from which the action of each of these instruments is approached is that of a reciprocating electric motor. In the body of the text the subject matter is developed with a minimum of mathematical calculations by means of the free use of graphical methods and mechanical analogies. The mathematical methods which are necessary for the quantitative solution of the various problems involved are placed for the most part in the fourteen appendices, which constitute between a quarter and a third of the volume.

A considerable portion of the material here presented has appeared in technical journals during the last fifteen years as contributions from Professor Kennelly's laboratory. The revision and co-ordination of all this work, in which he has had many collaborators, is written in the agreeable and lucid style for which the author is well known and makes the book a welcome addition to the libraries of all those who have occasion to employ this class of instruments for either instruction or research. L. P. WHEELER.

Die Materialprüfung der Isolierstoffe der Elektrotechnik

Second edition. By Walter Demuth. Berlin: Julius Springer. 254 pages, 132 illustrations.

During the world war the central European states were deprived of a great many raw materials essential to electrical manufacture. To overcome this shortage a vast number of substitute materials were developed and offered to the factories, not always with full success. It became therefore essential to subject these "Ersatz" materials to rigorous electrical and mechanical tests to determine to what extent they could replace their missing prototypes. More than ever before a comprehensive collection of testing methods and testing machines was needed—a demand which the author satisfied excellently with the book under notice. Only one year after the first edition appeared a second edition was demanded and work on it begun—a fact which speaks for its timeliness and adequacy.

The book is divided in two main parts dealing respectively with solid insulating materials and liquid insulators. The first part contains testing methods and enumerates about sixty solid insulating materials of natural and synthetic character. The testing methods comprise mechanical, chemical and electrical tests. The second part deals with properties and tests of oils, lubricants,

lacquers and various liquid and semi-liquid compounds. All material is gathered from the very latest publications and personal experiences of the author and represents probably the most up-to-date collection of its kind. The American reader will find in foreign current literature and advertisements frequent mention of insulating materials of more or less mysterious names, such, for example, as "Pertinax," "Repelit," "Ambroine," etc. Sixty of such materials are fully described in this book, which gives it great value as a data collection alone.

The most recently standardized testing methods for transformer and breaker oils form part of the second section. It might have been well to include mechanical and electrical methods of testing enameled wires, which are being used very extensively in every modern electrical plant. The excellent paper and cuts used in the book are worth special mention. A. PALME.

Elementary Principles of Lighting and Photometry

By John W. T. Walsh. New York: E. P. Dutton & Company.

The author of this book is associated with certain scientific and technical aspects of light and lighting in England, and naturally the book reflects this environment. To those interested in lighting in the United States this book will illustrate the general advancement of this country in lighting matters as compared with England, but at the same time the book is one of many indications that progress in England is being rapidly made.

Mr. Walsh ably treats the many general subjects, such as production, measurement and distribution, in the first half of the book, but the later chapters, dealing with specific fields of lighting, reflect a limited contact with actual lighting practice, although they contain a great deal of useful material. As an example of the futility of trying to incorporate in a single book applied lighting as well as principles of production, measurement and distribution of light the case of artificial lighting in schools might be cited. This is treated in a page or two. Incidentally, the author's treatment of school lighting is a good indication of how rapidly progress is being made in lighting, as well as of the difference in standards in this country and in England. It is evident that the author borrowed material rather widely, and, although a list of references is given, the book would be more valuable if the references were more numerous.

The volume should be of interest to any one in this country who wishes to broaden his viewpoint on lighting. Nevertheless, its material in general is in keeping with a stage of development which was passed in the United States some years ago. It should serve well in England, where and for which nation it was written.

M. LUCKIESH.

Vectorial Method to Calculate Long High-Voltage Lines

By Ernst Schönholzer. 16 pages, 16 vector diagrams and tabulations. Winterthur, Switzerland: E. Schönholzer.

Basing his method upon the Le Roy-Blandel series, the author derives graphical representations and develops a combined, exact and complete transmission diagram containing all the required data, such as current, voltage and phase displacement. The general usefulness of this new graphical method is explained by a practical example, which is carried out in detail. Designers of long high-voltage lines may use this new and apparently very simple method as a welcome means to check their customary way of calculation. A. PALME.

Book Notes

The Design of Diagrams for Engineering Formulas. By L. I. Hewes and H. L. Seward. New York: McGraw-Hill Book Company, Inc. 112 pages, quarto.

A presentation of methods fundamental to constructing time-saving diagrams which obviate the necessity of calculation of formulas. The methods are logically developed by the aid of a large number of diagrams, only essential mathematics being employed. The fifty-four practical examples include three or four different types of solutions applying to the same formulas. The large-size page used, though not common to engineering texts, eliminates the cramping of diagrams or use of folded sheets. The problems are such as to render the book valuable as a text.

Grundzuge der Starkstromtechnik. By K. Hörner. Berlin: Julius Springer. 257 pages, 319 illustrations.

A modern textbook covering in terse but concise manner practical problems of the entire electrical field. The constant presentation of examples taken from actual practice adds materially to its remarkable clearness.

Freileitungsbau-Ortsnetzbau. Fourth edition. By F. Kapper. Munich and Berlin: R. Oldenbourg. 388 pages, 376 illustrations.

Four editions within ten years is a rather unusual record for a technical book. The vast and complex subject of overhead-line calculations and constructions, as standardized by the V. D. E., including the latest additions, such as full data on steel-aluminum cables, is covered in complete detail.

Standards of the Electric Power Club. Fifteenth edition. 176 pages, paper, 8vo. Cleveland: Electric Power Club.

This fifteenth edition of Power Club standards marks the first time that the standards have been published separately from the "handbook." This is a real improvement. The octavo size, superseding the old handbook size, permits a much more effective typographical arrangement.

Power Club standards presented in this book are commercial engineering standards on electrical power apparatus. The book is fully cross-referenced to corresponding A. I. E. E. standards.

Yields of Bonds and Stocks. By David C. Johnson, Caleb Stone, Milton C. Cross and Edward A. Kircher. New York: Prentice-Hall, Inc.

This is a series of tables in which bond yields (to three places) are given directly for various prices, coupon rates and maturities without necessity of interpolating or prorating. Current income on bonds is also given. The book includes tables for yields of stock and an entirely new method of determining yields of premium bonds.

Principles of Direct-Current Machines. Third edition. By Alexander S. Langsdorf. New York: McGraw-Hill Book Company, Inc. 470 pages.

This third edition of the well-known textbook on direct-current machinery is largely a "refreshed" revision of the second edition, upon which it is an improvement. The design examples are kept as a necessary part of the treatment, though set aside typographically as illustrations.

A. S. T. M. Tentative Standards for 1923. Philadelphia: American Society for Testing Materials. 859 pages, illustrated.

Tentative specifications and testing methods for all kinds of material used in construction and operation of practically every industry. Copper wire, preservative coatings, waterproofing and insulating materials and rubber products are included.

Books Received

Elektronen und Ionen Ströme. By Dr. J. Zenneck. Berlin: Julius Springer. 48 pages, illustrated.

Advertising Campaigns. By Harry Tipper and George French. New York: D. Van Nostrand Company. 432 pages, illustrated.

Fundamentals of Radio. By James L. Thomas. New York: D. Van Nostrand Company. 207 pages, illustrated.

The Inspection and Testing of Materials, Apparatus and Lines. By F. L. Henley. London: Longmans, Green & Company. 355 pages, illustrated.

Messgerate und Schaltungen zum Parallelschalten von Wechselstrom-Maschinen. By Werner Skirl. Second edition. Berlin: Julius Springer. 137 pages, illustrated.

Technical Writing. By T. A. Rickard. New York: John Wiley & Sons. 337 pages. Second edition.

Continuous Current Circuits and Machinery. Vol. I. By J. H. Morecroft and F. W. Hehre. New York: John Wiley & Sons. 433 pages, illustrated.

La Construction des Bobinages Electriques. By C. Clement. Paris: Dunod. 202 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Locomotive Speed Record

Electric Engine Makes 105 Miles an Hour in a Trial Test Made at Erie, Pa.

A RECORD for an electric locomotive was made this week when one built by the General Electric Company and the American Locomotive Works for the Paris-Orleans Railroad in France attained a speed of 105 miles an hour in tests before two hundred steam and electrical railroad men from all parts of the country. The tests were made at the Erie (Pa.) works of the General Electric Company. According to officials of that company, only the shortness of the test tracks prevented the engine being sent still faster, probably reaching 125 miles an hour.

The locomotive is equipped for quick "pick-up," and in the first ten seconds after power was applied increased its speed at the rate of 2 miles an hour per second. At the end of the first sixty seconds it was traveling at the rate of 60 miles an hour and in about two minutes reached maximum speed.

An exhibition run of an electric freight locomotive for the Mexican Railway was staged, with a regenerative braking contest during which the electric locomotive, connected to send power back to the line, was hauled by a steam unit at a speed of about 14 m.p.h. As high as 1,800 hp. was sent back into the system.

Floods Destroy North Italian Power Plants

Heavy rains caused a dike leading from the artificial lake at Dezzo, near Bergamo, northern Italy, to give way last Saturday and inundate the whole country round about, with heavy loss of life and property. Five generating stations belonging to the Società dei Concimi Idraulici Industrial, the Società Bresciana di Angelo and the Ferrovie di Voltri were badly damaged, leaving the city of Bergamo temporarily without light. Dezzo, Menaggio, Queggio, Teveno, and four other small villages in the valley were wiped out by the raging waters.

Bergamo lies north of and between the large manufacturing cities of Milan and Brescia. Transmission lines connect it with the large interconnected network centering at Milan. The generating stations damaged were of the hydro-electric type and none was very large, and it is probable that at this season of the year enough energy can be transmitted over the interconnected system to take care of Bergamo.

Semenza Becomes President of International Commission

A cablegram from Paris to Dr. Clayton H. Sharp, secretary of the American committee of the International Electrotechnical Commission, says that at a meeting of the executive council of the commission held on Dec. 3 in Paris Guido Semenza, consulting engineer of Milan, Italy, and local honorary secretary in that city for the American Institute of Electrical Engineers, was elected president of the commission in succession to Dr. C. O. Mailloux of New York. Dr. Mailloux was made honorary president, being the first to fill this newly created office. Three new nations were admitted to representation on the I. E. C., and an entirely satisfactory meeting of the council was reported.

GUIDO SEMENZA

Aberdeen, Wash., for, Bellingham Against, City Plant

The voters of Aberdeen, Wash., at a general election on Dec. 1 carried by a small majority a measure authorizing the expenditure of $2,000,000 on the Wynoochee River project, intended to provide additional water and hydro-electric power to the city as a municipal enterprise. The Mayor and City Council are, however, pledged to obtain complete cost data on the undertaking before proceeding.

The voters of Bellingham, Wash., on the same day defeated a proposed bond issue for $500,000 intended to be used to supply municipal power.

Muscle Shoals Fight On

Congress Is Preparing to Renew Its Contention Over Ford—Latter Sees the President

THE new Congress had not perfected its organization when bills for the disposal of the government's properties at Muscle Shoals were tossed into the hopper of the House. All of the several early measures provided for lease of the projects to Henry Ford.

Representative J. C. McKenzie of Illinois reintroduced without change the bill agreed upon in the last Congress by a majority of the members of the House military affairs committee. This provided for acceptance of the Ford offer for the hydro-electric development, the nitrate plants, quarry, railroad and other properties on the terms of the Ford bid, but excluded the Gorgas steam plant, now disposed of to the Alabama Power Company. It was the exclusion of this auxiliary plant which caused several minority bills to come from the committee in the last Congress.

Representatives Vinson of Georgia and Almon of Alabama introduced bills accepting the Ford offer without change. These bills evidently would make it incumbent upon the government to build a new steam plant on the Warrior River with a transmission line to Muscle Shoals.

Henry Ford, accompanied by one of his engineers and one of his lawyers, had a conference with the President on Monday which has been made the occasion for much speculation, but no authoritative statements have been made as to the purpose of the visit. Mr. Ford also visited Secretary Weeks.

President Coolidge on Muscle Shoals and Fertilizer

President Coolidge's opening message to Congress, delayed by the contest over organization in the House of Representatives, was delivered on Thursday. It contained this reference to Muscle Shoals:

"The government is undertaking to develop a great water-power project known as Muscle Shoals, on which it has expended many million dollars. The work is still going on. Subject to the right to retake in time of war, I recommend that this property with a location for auxiliary steam plant and rights-of-way be sold. This would end the present burden of expense and should return to the Treasury the largest price possible to secure.

"While the price is an important ele-

ment, there is another consideration even more compelling. The agriculture of the nation needs a greater supply and lower cost of fertilizer. This is now imported in large quantities. The best information I can secure indicates that present methods of power production would not be able profitably to meet the price at which these imports can be sold. To obtain a supply from this water power would require long and costly experimentation to perfect a process for cheap production. Otherwise our purpose would fail completely. It seems desirable, therefore, in order to protect and promote the public welfare, to have adequate covenants that such experimentation be made and carried on to success. The great advantage of low-priced nitrates must be secured for the direct benefit of the farmers and the indirect benefit of the public in time of peace and of the government in time of war. If this main object be accomplished, the amount of money received for the property is not a primary or major consideration.

"Such a solution will involve complicated negotiations, and there is no authority for that purpose. I therefore recommend that the Congress appoint a small joint committee to consider offers, conduct negotiations and report definite recommendations."

Utilities Commissioners Meet at Miami

Committees Declare Uniform Regulation by All States Desirable, Demand Continuous Service and Urge Close Supervision of Depreciation Reserves

ONE of the noteworthy reports presented at the Miami (Fla.) convention of the National Association of Railway and Utilities Commissioners, in session from Tuesday to Friday of this week, was that of Lewis E. Gettle, chairman of the Wisconsin Railroad Commission, who laid bare to the association at its open session the widely different methods that are pursued throughout the nation in the regulation of public utilities. Mr. Gettle, as chairman of a special committee appointed last year, presented a 300-page digest of railroad and utility regulatory laws of the various states, the first one of its kind ever compiled.

"Little or no progress has been made toward the unification of laws regulating public utilities," declared Chairman Gettle. "The marvelously rapid movement toward consolidations and extensions of electric properties, many times with power plants in one state and distributing systems partly in the state in which the power is situated and partly without the state, has suggested to forward-looking regulatory bodies a necessity for bringing about some measure at least of uniformity of practice in all the states concerned. The movement toward the development of superpower plants at or near the vicinity of the great coal deposits and the transmission of power over much longer distances than is at present accomplished has also seemed to emphasize the necessity for action in this direction.

"Our survey shows there are forty-nine commissions working under a wide dissimilarity of laws. In several of the states the commission, in fixing rates, is still limited to the establishment of maximum rather than absolute rates. In some of the states the commission has been granted extensive power and authority over the question of competition and the prevention of duplication of equipment through the use of the certificate of public convenience and necessity. In other states no such power has been conferred upon the commission. Many of the states have merely regulatory laws applicable to railroads. Others have laws for the regulation of privately owned utilities but exempting municipally owned utilities from such supervision. Power to regulate the issuance of stocks, bonds and other securities remains unprovided for in about half of the states, and in the states which do provide it there are fundamental differences. The vital subject of valuation is also subject to a marked degree of variation. While some uniformity does exist between the several states, there still remains much to be done in bringing about the efficiency and the sanction which results from sound and uniform regulation."

The committee is not yet prepared to submit tentative drafts of proposed uniform legislation.

Service Must Be Continuous

Basing his report on service of public utility companies on a situation in New Jersey where a railway company discontinued service for a period of fifty-one days because it claimed its earnings were insufficient to grant wage increases demanded, J. J. Divine, chairman of the committee and of the West Virginia Public Service Commission, recommended that it be declared to be the policy of regulation that "continued and uninterrupted service must be rendered to the public at large as long as the franchises are retained, that the franchise obligation to serve shall always be construed to mean continuous and uninterrupted service." It was suggested that state laws be drafted to establish this fundamental principle of service firmly and unquestionably.

The committee on public utility rates devoted the greater portion of its report to considerations of depreciation reserves. E. R. Hughes of the Oklahoma commission contributed the argument. In substance it asked that the handling and accounting of depreciation reserves should have strict supervision by commissions, so that it may not be dissipated in dividends or capitalized or camouflaged as operating expense, but be kept liquid and available as a guarantee or insurance of continuous service. The provisions of an order of the Oklahoma commission covering the matter were cited.

A prophecy that in the future electric power would be manufactured at points near the source of coal and water supply and transmitted to operate the industries and railroads of the United States by a gigantic system of interconnected transmission lines was made by W. S. Murray of New York, who spoke as the representative of Secretary of Commerce Hoover. He declared that in the North Atlantic States, despite the fact that the Potomac, the Hudson and the Connecticut Rivers ran through them, only 20 per cent of the needed power could be manufactured by hydro-electric plants.

Officers for 1924 were elected as follows: President, Henry G. Taylor, chairman Nebraska State Railway Commission; first vice-president, W. D. B. Ainey, chairman Public Service Commission of Pennsylvania; second vice-president, A. G. Patterson, president Alabama Public Service Commission; secretary, James B. Walker, secretary New York Transit Commission; assistant secretary, Lewis G. Thompson, Florida Railway Commission; general solicitor, John E. Benton.

Hoover Again Asks for Radio Regulation

"The rapid growth of radio communication makes necessary an affirmative declaration by Congress of a governmental policy in accordance with which the art is to be conducted and the empowering of some agency to carry that policy into effect. This can only be done through an officer with discretionary powers and under regulations which will be made by him in conformity with the general terms of the law. I most earnestly commend this matter to the attention of Congress."

In these words Secretary of Commerce Hoover will in his forthcoming annual report to Congress urge the importance of national regulation of the radio situation. The recommendations made by the second national radio conference last March and adopted by the department virtually in their entirety have, Mr. Hoover will say, reduced interference greatly; but he goes on to observe:

"Facilities for the enforcement of the present law are wholly inadequate. There are some twenty-five thousand stations now sending radio messages within our country or along our coasts. The law requires the inspection of all these stations, and if this inspection is to be sufficiently efficient to accomplish results in the character of equipment and prevention of interference it must be performed with reasonable frequency. To inspect these twenty-five thousand stations the department now has a total force of twenty-nine men, all that can be employed within the limit of the appropriation. Manifestly, under such a condition, effective inspection is impossible."

Hydro-Electricity Topic of A. S. M. E.

Held that Superpower Development Will Not Reduce Present Cost of Energy—Possibilities of Bleeding and of Extraction Cycles—Coal Handling and Storage

A FEATURE of the annual convention of the American Society of Mechanical Engineers held in New York Dec. 3-7 was an evening meeting on hydro-electric developments at which representatives of the A. S. C. E., the A. S. M. E. and the A. I. E. E. presented papers.

Of great interest to central-station engineers was a session on the possibilities of bleeding and of extraction cycles in securing greater economy in energy production. A digest of these papers and the discussion on them will appear in the next issue of the ELECTRICAL WORLD.

The convention program was replete with papers covering new developments in mechanical engineering and industrial management, and the attendance was very large. Outstanding papers of value to electrical men were "Salt Velocity Method of Measuring Water Flow," by C. M. Allen; "The Oscillographic Method of Measuring Water Flow," by N. R. Gibson; "Fundamental Factors in the Spontaneous Combustion of Coal," by O. P. Hood; "Coal Handling and Storage," by H. E. Birch and H. V. Coes, and "Economical Status of the Oil Engine," by L. H. Morrison.

Progress was made at the sessions on power test codes, fuels and other division activities. The very successful Power Show added greatly to the interest in the convention, the exhibits proving unusually interesting and instructive.

PRESIDENT HARRINGTON'S ADDRESS

The address by the retiring president, John Lyle Harrington, was a searching analysis of the engineer's status in industry, in business and in public affairs, with suggestions for overcoming some of the present shortcomings. It is only within recent years, Mr. Harrington said, that engineers have emerged from the artisan class, and something of the old tradition still remains in the public mind. The engineer has been so intent upon devising means of production that he has failed to establish his position as to the other leading factors in our social life. He is too prone to assume the rôle of an employee and devote himself to the interests of his individual employer. He is usually looked upon as a specialist, and there has not been accorded to him by financiers full confidence as a business man, but his scientific methods applied to those problems which are too complicated for the business man's solution or judgment should result in better understanding of the fluctuations in business and assist in remedying the conditions responsible for non-employment.

Citing the case of the railroad and water transportation systems, Mr. Harrington showed how the engineer has replaced speculative financing with most beneficial results. Another important problem awaiting solution on which the engineer can bring his training to bear is, he said, that of distribution.

While engineers consider themselves competent to organize industry, they have failed, the speaker maintained, to organize effectively their own profession. There are too many groups of narrow and specialized interests as contrasted with certain of the other professions, such as the law, in which the Bar Association exerts the whole professional weight in public affairs.

Mr. Harrington concluded his address with observations on professional ethics and the advisability of making engineering a closed profession by legally establishing the professional status of every private practitioner and of every engineer employed by others. Only a few states now require examinations and records that show the real status of the licensee. The only way to prevent the unqualified from assuming the name of engineer is by closing the profession, as has been done in law and medicine.

THE HYDRO-ELECTRIC SESSION

At the hydro-electric meeting on Wednesday evening President J. L. Harrington indicated the necessity for engineers to disseminate accurate knowledge of the possibilities of water power. Past-president L. B. Stillwell of the A. I. E. E., as presiding officer of the meeting, outlined the results that will be obtained by adequate hydro-electric development and spoke of the division of activity between the various kinds of engineers.

The principal address was given by John R. Freeman, past-president of the A. S. M. E. and the A. S. C. E. Mr. Freeman stated that applications have been filed with the Federal Power Commission to develop 21,000,000 hp., compared with 9,000,000 hp. now developed. Conferences on the subject, he said, have their greatest value through their educational effect on the public, and he outlined the fundamental principles which underlie the proper development of hydro-electric power as being, first, that a hydro-electric development must show a profit and, second, that it must contribute to public welfare in the highest degree. He could see no reduction in the cost of power through the use of superpower or mouth-of-mine plants because of the cost of distribution and transmission. The value of these developments would lie in their maintaining the cost of power at its present low figure.

Mr. Freeman outlined the marvelous technical developments in hydro-electric equipment and traced the historical development of the power industry. He then accented the limitations and discussed the problems associated with the development of water power as based on the two fundamental principles he had enunciated.

Conservation of capital, Mr. Freeman said, must always be considered along with the conservation of natural resources. This frequently will lead to a departure from the line of engineering development that would be ideal at a given site because of the menace of an unsatisfied interest charge upon capacity provided but not promptly put to use. He thought the rejection of the constitutional amendment designed to open the Adirondack region in New York State for the generation and transmission of electrical energy showed no real understanding of the facts by the voters at large.

ST. LAWRENCE POWER

Mr. Freeman quoted the opinion of "one of the most experienced among the builders and managers of large electric power developments in America" that there was no money to be saved by bringing hydro-electric power to Boston from the St. Lawrence and that steam plants could deliver energy just as cheaply. Other eminent engineers, he said, are just as strong in the opposite belief. Rare circumstances, he held, may present a condition of great blocks of power so abnormally cheap that an abnormally large percentage of loss in transmission may be allowable. Perhaps, the speaker concluded, ways can be found to bring St. Lawrence power to New York and Boston so cheaply that it will cost delivered, say, 0.1 cent per kilowatt-hour less than steam power generated at Fall River, Boston or New York.

The fundamental problems are: How soon will this power be needed? How much of it is needed? What will it cost? How much can be paid for it?

Col. John P. Hogan discussed the need of accurate engineering data before proceeding with the development. Many failures have occurred because of overestimation of the water resources and because estimated costs have been exceeded. Average run-off records should be used with very great care and the theory of probabilities should be applied to any short-term records. Hydro-electric sites should be properly explored before any cost estimates can be taken as worth while.

George Orrok discussed the cost of water power in comparison with the cost of steam power, particularly in connection with long-distance transmission. H. W. Buck discussed the distribution of power from the generating sources. He stated that the comparative cost of steam and water power befogged the issue, as in the East at least water power must be used in connection with steam power. William White discussed the great advantages that would ensue through the greater development of our power resources. J. P. J. Williams discussed the proposal of hydro-electric power production through public ownership and operation and cited the development of the Ontario system. L. B. Stillwell pleaded for standardization of potentials and frequency.

Electric Trucks and Good Will Topics at Salt Lake

Interest in the meeting of the National Commercial Section of the N. E. L. A. held at Salt Lake City Nov. 21 and 22 was, as already reported, concentrated in large part on the electric range meeting, but the discussion on electric trucks and an unscheduled public relations meeting came in also for their share.

Very encouraging progress in promoting the commercial electric truck was reported at the meeting of the Transportation Bureau, presided over by Chairman Skinner. Results accomplished on the Pacific Coast were brought out by the California delegates. It was shown that thirty-three trucks have been sold so far and that this number will probably be greatly exceeded before the end of the year. The national committee reported the sale of more than 800 street trucks this year. The revenue to the central station at 5 cents per kilowatt-hour is $300 per year for each truck. The average life of storage batteries is now three years, and this is gradually increasing.

So much interest was shown in the plan of the greater service bureau of the Southern California Edison Company as presented by W. H. Fischer of that company that a special meeting to discuss ways of combating municipal ownership was called. This meeting was well attended, and Mr. Fischer presented in detail the plan of his department for thoroughly organizing the employees. A. K. Baylor, Schenectady, favored making capitalists out of every one by the sale of securities. He thought that the fight against public ownership must be carried outside the electrical industry.

The next meeting of the Commercial Section will be held either in Cleveland or St. Louis, according to present plans.

Chicago Sanitary District Doubles Light Rate

The Sanitary District of Chicago has just notified the city of Chicago that, effective Jan. 1, 1924, the energy rate for the street-lighting system will be increased from 4.4 mills per killowatt-hour to an arbitrary rate of 8.5 mills. This means an additional cost of $200,000 a year for operating the system. The new rate, however, runs hand in hand with the Commonwealth Edison Company's energy rate for the same type of service.

Commissioner John T. Miller of the Department of Gas and Electricity said that the contract under which the city and the Sanitary District have been operating for six years contained several features which interfered with the satisfactory operation of the lighting system. One of these has been the division of the city into three zones lighted at intervals of fifteen minutes, the last zone to be lighted being thus subjected to a half hour of darkness. To obviate this it has become necessary for the Sanitary District to drop its so-called commercial load, which means a serious loss of revenue to it. The Sanitary District is willing to incorporate in the contract a clause that will permit the city to adjust the rate at the end of each year so that neither a profit nor a loss shall be shown by the Sanitary District. In other words, the city will virtually control the Sanitary District's electrical department.

Another reason for the advance in rates is that the sewage-treatment program has now developed to the point where the plants in operation are consuming much of the Sanitary District's generated energy and may in two years consume its entire output.

Six Months' Work of New York Electrical Board

More than five hundred representative electrical men of New York City attended on Dec. 5 the first "members' meeting" of the newly organized Electrical Board of Trade of New York and heard reports of the board's achievements to date from its president, Arthur Williams; the chairman of its board of governors, Charles L. Eidlitz, and other speakers.

Theodore Beran, representing the manufacturers; William Kennedy, representing the jobbers, and Frank Pattison, consulting engineer, testified to the value of the electrical board of trade idea and the importance of full membership by the local industry. Tribute was paid to the work of Charles L. Eidlitz in directing the activities of the organization.

Called upon by President Arthur Williams, Mr. Eidlitz recounted the work of the board's office in handling individual and group trade problems, speeding up the granting of inspection certificates, eliminating the illegitimate transfer of contractors' licenses, promoting the abolishment of the one-dollar permits for work by building electricians, settling bankruptcy cases without legal costs, putting an end to price cutting on appliances between rival department stores, insuring elimination of the "all-saving" clause in engineers' specifications, reporting on moral risks of electrical business men, restoring stolen goods to owners, adjusting complaints against utility companies and contractors, establishing building loans and group insurance for electrical employees and abolishing special privileges. Altogether in the six months of its existence, estimated Mr. Eidlitz, the new organization has saved the industry about $500,000.

Asked to "pronounce a benediction," James H. McGraw, president McGraw-Hill Company, commented upon the inspiring and highly practical character of the work being accomplished by Mr. Eidlitz and assured his hearers that the McGraw-Hill electrical papers stood squarely behind the New York Electrical Board of Trade idea.

Substantial Rate Reductions for Wisconsin Towns

The Wisconsin Railroad Commission is making an intensive study of the rate agreement recently reached by representatives of forty-nine Wisconsin cities and villages and the Wisconsin-Minnesota Light & Power Company. (See ELECTRICAL WORLD, Nov. 24, page 1082.) While it will probably be some time before the commission submits its findings, it is expected that the agreement will not be greatly altered. This agreement is intended to produce a revenue in each of the cities concerned substantially less than the company collected on the same consumption under the "loop" rates of October, 1920. The schedule, if approved by the commission, is to remain in force for six months, during which time the commission is to work out its effect, subsequently increasing or decreasing it, if necessary, to produce the stipulated return. The yearly reduction in revenue in Eau Claire will amount to $60,744; in Chippewa Falls, $20,485; in La Crosse, $60,655; in Menomonie, $14,926; in Neillsville, $3,360 per year.

The important element of the proposed schedule is that it is based upon the actual cost of serving each community and not upon the average cost of serving many communities. The cost of service shows the cost of transmitting, transforming and local distribution. An example of how the reduced schedule will affect a five-room house is given as follows: In the new schedule 10 cents will be charged for the first 25 kw.-hr., 7 cents for the second 25 kw.-hr., and all in excess of 50 kw.-hr. will be paid for at the rate of 4 cents. Under the old schedule 10½ cents was charged for the first 50 kw.-hr. and 8½ cents for the next 50 kw.-hr., and all in excess of 100 kw.-hr. was charged for at the rate of 7 cents.

Supreme Court Reaffirms Its West Virginia Gas Finding

The United States Supreme Court on Monday of this week reaffirmed the decision it handed down in June declaring unconstitutional the West Virginia law which would have compelled natural-gas companies piping gas from that state to supply needs within the state before sending gas into other states in periods of shortage. The vote of the court was five to three, one justice not participating, as was the case in the original decision.

In its original decision the court declared that natural gas which has been piped into other states assumes the character of interstate commerce. A rehearing was granted West Virginia. The latest opinion merely recites that nothing was presented to change the first opinion of the court. The decision was on consolidated suits brought by Pennsylvania and Ohio against West Virginia. As previously pointed out, this decision has an obvious bearing on interstate transmission of electricity.

Radio Corporation Has Monopoly

Because of Its Control of Essential Patents, Federal Trade Commission Says, Transoceanic Competition Is Not Possible—History of Company

THE Radio Corporation of America has a virtual monopoly of commercial wireless communication between this and foreign countries, according to a report made public on Monday by the Federal Trade Commission. The report is the outcome of an investigation made under a resolution passed by the last Congress.

The commission first gives the outcome of a study of the radio industry from its beginning, going back to the organization on Nov. 22, 1899, of the Marconi Wireless Telegraph Company of America, the first to be formed in this country to engage in the transmission of messages by wireless, and 25 per cent of which was owned by the Marconi's Wireless Telegraph Company, Ltd., a British corporation.

The commission then gives in detail the history leading up to the organization of the Radio Corporation of America by the General Electric Company on Oct. 17, 1919, and says:

"On Nov. 20, 1919, the Radio Corporation entered into an agreement with the Marconi Wireless Telegraph Company of America whereby, in exchange for 2,000,000 shares of its preferred stock, of a par value of $5 a share, it took over the physical properties, patents, licenses and good-will of the Marconi company."

The original capital stock of the Radio Corporation, the report says, was $1,000, but at the first meeting of the stockholders it was increased to $25,000,000. On Dec. 31, 1922, there were outstanding 3,955,974 shares preferred stock, par value $5 per share, and 5,734,000 shares common stock, no par value. Of this amount the General Electric Company owns 1,875,000 shares common and 620,800 shares preferred, the Westinghouse Electric & Manufacturing Company 1,000,000 shares common and 1,000,000 shares preferred, and the United Fruit Company 160,000 shares common and 200,000 shares preferred. The remainder is held largely by the former stockholders of the American Marconi Company.

Cross-License Agreements

"The Radio Corporation," the report continues, "has entered into agreements with the various companies which own or control practically all patents covering radio devices considered of importance to the art. The number of patents involved approximates two thousand. Agreements of this character have been entered into with the General Electric Company, Marconi's Wireless Telegraph Company, Ltd., American Telephone & Telegraph Company and its subsidiary, the Western Electric Company; the United Fruit Company and its subsidiary, the Wireless Specialty Apparatus Company; the International Radio Telegraph Company, the Westinghouse Electric & Manufacturing Company and the Radio Engineering Company of New York. With certain minor limitations, the Radio Corporation under these agreements has secured an exclusive divisible right to sell and use the radio devices covered by the patents involved or by patents which these companies may acquire before the termination of the agreements. The agreements with the American Telephone & Telegraph Company and the Western Electric Company are to terminate in 1930, while the remainder are to terminate in 1945. Provision is made for the mutual exchange of information relating to radio, and in most instances the Radio Corporation has granted to the other company a license under its patents to make and use devices in the particular field in which the other company is interested.

"The Radio Corporation, under these agreements, is made the selling company for practically all radio devices to be sold the public under the hundreds of patents involved. The General Electric Company and the Westinghouse Electric & Manufacturing Company are to manufacture, and to sell to the Radio Corporation only, these devices and apparatus, the Radio Corporation agreeing that 60 per cent of its annual requirements would be purchased from the General Electric Company and 40 per cent from the Westinghouse company. Until the expiration of the Fleming patents in 1922 the Radio Corporation had an absolute monopoly in the sale of vacuum tubes. On the expiration of these patents the De Forest Radio, Telephone & Telegraph Company, which had retained a right to manufacture and sell, commenced the sale of such tubes to the general public. In the sale of receiving sets the Radio Corporation has competition from seventeen concerns licensed under the Armstrong patents, although their sale of sets for use in conjunction with tubes is being contested in the courts at the present time. It is contended that their sale and use under the present patent situation constitutes an infringement of the tube patents of the Radio Corporation, which if upheld by the courts will prevent all competition in the sale of complete sets, since the Western Electric Company is manufacturing and selling only transmitting apparatus for commercial purposes."

Transoceanic Monopoly

The Federal Trade Commission says further:

"Because of the provisions in various agreements providing for service through the facilities of the Radio Corporation exclusively, it is not believed that it will be possible for any other company in the United States to conduct an efficient transoceanic service. In fact, a group of newspaper publishers in the United States who sought to erect a station for the receipt of radio messages, after conducting experiments in this country, eventually built such a station at Dartmouth, Nova Scotia. This station is now being operated, its service being supplemented by virtue of an arrangement with the British Post Office."

The commission confines itself to the presentation of the result of its fact-finding activities, leaving it to Congress to determine whether the anti-trust laws have been violated.

Pioneers

—From *American Farm Bureau Federation Weekly News Letter*, Nov. 8, 1923.

Beck Plans for Steam Auxiliaries to Hydro System

Sir Adam Beck, chairman of the Hydro-Electric Power Commission of Ontario, confronted with a shortage of power from the hydro plants of that system, has turned to the plan of steam auxiliary plants. With the necessary permission from the government, he declared in a recent speech, he will be ready to proceed as soon as possible with the installation of a large steam unit in Toronto, costing probably between $8,000,000 and $9,000,000, with an immediate capacity of not less than 100,000 hp. and an ultimate development of 300,000 hp. This would release at once a similar amount for other municipalities.

"There is nothing for the East that I can see, unless we undertake some development on the Ottawa River or establish a steam unit at, say, Cobourg, with probably 50,000 hp.," he continued.

With these auxiliary units supplying 40 per cent of the total power output and the development of the St. Lawrence finally realized, Ontario would have, in thirty or forty years' time, 4,500,000 hp. or even 5,000,000 hp., said the commission chairman. Once the St. Lawrence scheme was accomplished, he said, it would be a simple matter to consolidate several of the present systems, reducing the twelve now existent to five.

Representative Bacharach Reintroduces His Bill

Congressman Isaac Bacharach of New Jersey has reintroduced his bill to amend the federal judicial code so as to prevent public utility corporations from appealing to the United States district or circuit courts to set aside decisions of state public utility commissions.

Mr. Bacharach will make a determined effort to obtain favorable action on his bill, he declared, and hopes to secure its enactment by Congress before spring. He introduced the bill first in January, 1922, but has been unable to get action on it by the House judiciary committee, to which it was referred. Hearings were held on the Bacharach bill by the judiciary committee in the summer of 1922 and again in the winter of 1922-3. Representatives of the utility commissions of New Jersey, New York and several other states appeared before the committee, as well as attorneys for the utility corporations.

Commonwealth Edison Pushes Crawford Avenue Station

The industrial demand for energy for southern Chicago is growing so rapidly that the Commonwealth Edison Company has been required to complete the construction of its switch house at the new Crawford Avenue station before the completion of the plant. A load of 15,000 kw. is soon to be distributed from this point, although the first unit of the new station will not be in operation for more than a year. Underground cables from the Calumet station, 17 miles away, will serve the substation at 33,000 volts.

More than eight hundred men are now employed erecting this 600,000-kw. Crawford Avenue plant, which will cover 72 acres. To hasten the work huge batteries of floodlamps have been placed in use. An underground tunnel 537 ft. long was recently completed for the purpose of carrying the underground service cables to the various substations. This tunnel runs under the Chicago Drainage Canal and is the fifteenth built by the company.

Engineering Council for Interior Department Reform

Fearing failure of the Brown plan of government reorganization, devised by the joint committee of the House and Senate and sponsored by the late President Harding, the American Engineering Council of the Federated American Engineering Societies will conduct a country-wide movement to make over the Department of the Interior in accordance with that part of the Brown plan which affects this department, and a bill to accomplish this end will be introduced at the present session of Congress. A national conference on public works will be one of the events of the Washington meeting of the Engineering Council to be held in the second week of January. This public works conference will be held on Wednesday, Jan. 9.

The opening event of the week will be a meeting on Monday of the committee on procedure of the American Engineering Council, followed on Tuesday by deliberations of the executive board. On Thursday and Friday the full membership of the council will convene for its annual sessions, facing an agenda presenting a wide range of social, industrial and scientific questions.

A successor to President Mortimer E. Cooley of Ann Arbor, Mich., will be elected.

Brief News Notes

South Dakota and Nebraska Merger.—Permission for a two-million-dollar merger has been granted by the Nebraska Railway Commission to consolidate light and power plants at Columbus and North Platte, Neb., and Aberdeen, and Clark, S. D., and the Waterloo-Henry transmission line near Aberdeen.

A Twelve-Year-Old Rate Case Ends.—After twelve years of litigation, the city of Everett, Wash., has lost the rate reduction case instituted originally against the Puget Sound International Railway & Power Company. The city attempted twelve years ago to effect a reduction in lighting rates in Everett, and the case, after being dragged through one court after another, was finally settled on Nov. 13 by the United States District Court, which upheld the power company.

Big Project for Youghiogheny River.—A project to utilize for power the Youghiogheny River waters in Garrett County, Maryland, has been outlined to the Maryland Public Service Commission. The power would be sold to the Penn Public Service Company and distributed throughout western Pennsylvania. The plan contemplates the development of about 100,000 hp. and the construction of a water-power dam and tunnel. It would cost more than $35,000,000

Electric Truck Instruction Course.—A course of instruction designed for operators of electric trucks and garage attendants, under the auspices of the New York Electric Vehicle Association, began last Wednesday at Irving Place and Fifteenth Street, in the auditorium of the United Gas Company, and will continue until the end of May, lectures being given every two weeks. Charles R. Skinner, Jr., is secretary of the committee in charge.

Clintonville, Wis., Sticks to Central-Station Supply.—The City Council of Clintonville, Wis., has defeated a proposal to build a hydro-electric generating station at Big Falls at a cost of about $150,000 and will continue to purchase energy from the Central Wisconsin Power Company for the operation of the municipal electric plant.

Consumers' Power Starts New Dam on Manistee River.—Work has begun on a third dam on the Manistee River for the Consumers' Power Company. The new plant will develop 20,000 hp., which, added to the power now developed at Junction Dam, will make the Big Manistee River produce 50,000 hp., while the smaller dam on the Little Manistee adds several thousand more. The site of the new development is 15 or 20 miles farther up the Big Manistee than Junction Dam, on the line of Manistee and Wexford Counties, and the station will designated "Coline."

New Wisconsin Hydro-Electric Plant.—Another power dam will soon be added to the increasing number now built on the Wisconsin River. The Wisconsin Valley Electric Company is about to construct a hydro-electric power plant about 4 miles north of Merrill at Bill Cross Rapids. The power developed will relieve somewhat the excess loads now carried by the Wausau, Merrill, Stevens Point and other plants. It is expected to generate about 5,000 hp. during normal water-level periods. Later the company plans to develop a water-power site which it owns at Trappe Rapids, 5 miles from Merrill.

Progress of Flaming Gorge Project.—The Utah Power & Light Company expects to be ready within a few months to apply for a license covering its Flaming Gorge project. Borings have been completed, as has practically all the field work. It still remains to be determined which of the dam sites will provide the maximum of ultimate economies. This project will provide 3,000,000 acre-feet of storage, which will control the entire run-off of the Green River at that point. The improvement will have a beneficial effect on the low-water situation below.

Chandlerville Utility Sold to Public Service Company.—Because ninety-five of the citizens of Chandlerville, Ill., had subscribed for 315 shares of preferred stock in the Central Illinois Public Service Company, enough pressure was put upon the Village Council to vote the sale of the local municipal plant, which has operated on a dusk-to-dawn basis for the past twelve years, to the Central Illinois Public Service Company. The company is constructing a 10-mile transmission line to Chandlerville from Virginia, Ill., and will build a substation at the former place, besides rehabilitating the distribution system there. Rates for the new twenty-four-hour service will be lower than those charged by the municipal plant.

Great Falls of the Potomac Project to Come up Again.—Senator Norris of Nebraska has announced that he will do all in his power to bring about passage at the session of Congress just begun of a bill embodying the so-called Tyler plan for a hydro-electric plant on the Great Falls of the Potomac, 18 miles from the capital, which is designed to supply the federal government and the people of Washington with cheap electrical energy. This scheme provides for the construction of two dams, one at Great Falls and the other at Chain Bridge, and for three extensive storage reservoirs on Great Cacapon River, the North Fork of the Shenandoah and the South Branch of the Potomac. The appropriation called for, by figures of 1921, is $44,120,000.

Tacoma's Lake Cushman Project.—Bids for the construction of the first unit of the proposed Lake Cushman power project, under development by the city of Tacoma, Wash., will be received in December, according to Commissioner Ira L. Davisson of the Tacoma Light and Water Department. It is estimated that the city will ultimately expend $10,000,000 on this plant, with a total development of 140,000 hp. The cost is put at $9,905,000, or a little less than $71 per horsepower. The first unit will be rated at 50,000 hp., the second unit at 45,000 hp. The engineers expect to have the first unit completed by Dec. 1, 1925. A concrete dam, 235 ft. high, with wing walls on either side, at the top of the rock canyon on the Skokomish River, will be built.

Rapid Transformer Installation at Buffalo.—Thirty-six hours after the final inspection of a 30-ton transformer in Pittsburgh temporary installation had been made by the Buffalo General Electric Company at Station No. 2, Elk and Ohio Streets, Buffalo. The score or more of men who made the installation completed their work Monday morning, Nov. 26, after working all night. This is believed to be a record for the transportation and installation of a transformer of this size. The transformer without the oil weighs 54,000 lb. It holds 3,300 gal. of oil and has a rating of 2,280 kw. It was installed to replace one which had burned out Nov. 22.

Bangor Company Plans 30,000-Kw. Hydro-Electric Station.—Expansion of generating plant facilities by the Bangor (Me.) Railway & Electric Company is slated for the near future, according to a statement last week by E. M. Graham, president of the company, to a representative of the ELECTRICAL WORLD. Studies have been made for a new 30,000-kw. hydro-electric station, and by the early part of January it is expected that the full benefit of dam reconstruction above the present Ellsworth water-power station will be again enjoyed. Only about 75 kw. of steam plant capacity is in use on this system. Conditions in the lighting and power department are excellent from the standpoint of business development.

Eight Maryland Plants Unite.—It is reported from Elkton, Md., that the Eastern Power Company has taken over the Oxford (Pa.) Electric Company and the Rising Sun Electric Company, Port Deposit Power Company, Perryville and Havre de Grace Electric Light companies and Gilpin Falls Power Company of Elkton and North East, all in Maryland, and has completed a deal for the Home Power Company, which does business in Elkton and Chesapeake City. The Eastern Power Company is at present getting part of its energy from McCall's Ferry, Pa., but after the completion of the new hydro-electric plant at Conowingo the combined companies will derive their power from the Conowingo Electric Company.

Calumet (Wis.) Controversy Is Settled.—A settlement has been arranged between the Eastern Wisconsin Electric Company and the Badger Public Service Company of the dispute over the construction and operation of lines to furnish electrical energy in the town of Calumet. In November, 1922, the Railroad Commission granted the Eastern Wisconsin Electric Company permission to extend its lines into this town. Similar permission was sought by the Badger Public Service Company, and the Circuit Court decided in its favor, appeal then being taken to the Wisconsin Supreme Court by the Eastern Wisconsin Electric Company, where the case is pending. The two companies have now come to an amicable agreement, the Railroad Commission acting as arbitrator, limiting the sphere of each in supplying service to Calumet, and the case is to be dropped from the calendar of the Supreme Court.

Cumberland River Development Delayed.—Delay has been met by the Cumberland Hydro-Electric Power Company in its effort to begin the development of its 200,000-hp. project between Burnside and Williamsport, Ky., on the Cumberland River. The Cumberland company, which is backed by Insull interests and by D. H. Rollins & Sons, filed its application nine months ago along with incontrovertible evidence showing financial ability to carry through the project and a desire to proceed rapidly with it. Some delay was inevitable because the city of Louisville had filed previously on one of the sites. Two months ago, however, the district engineer, after conducting a public hearing, submitted his report to the Chief of Engineers. The report is still under consideration in that department, and it is reported that navigation interests in Nashville are opposed to the plan.

Associations and Societies

Byllesby Accountants at Convention.—For the purpose of improving the methods and increasing the efficiency of their accounting departments, more than two hundred accountants of the Byllesby Engineering & Management Corporation attended a four-day conference at Oklahoma City, Nov. 19 to 22. This was the fourth annual convention of this accounting section.

Middle West N. E. L. A. Conference.—A conference of the Middle West Geographic Division of the N. E. L. A., which includes Nebraska, Iowa, Kansas and Missouri, will be held at the Kansas City Athletic Club, Kansas City, Mo., on Jan. 11, for committee reports and discussions and to make arrangements for the annual convention next spring.

Pittsfield (Mass.) A. I. E. E. Section Has Varied Program.—D. H. Rodinger, resident engineer of the Big Creek development, told this section about the Southern California Edison Company's 220-kv. transmission system on Dec. 7. Among other topics announced for the winter meetings are "The Electrification of Railways," by A. H. Armstrong, General Electric Company, Dec. 13; "Transoceanic Radio," by F. H. Kroger, Radio Corporation of America, Feb. 7; "The Pallatophone," by Dr. C. A. Hoxie, General Electric Company, and "Type SCR Single-Phase Motor," by H. R. West, General Electric Company. President H. J. Ryan of the A. I. E. E. will address one meeting, and there will be papers at others on scientific subjects not strictly electrical.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

Accounting National Section, N. E. L. A.—Hotel Muehlbach, Kansas City, Dec. 10-11.

New York Electrical Credit Association—Building Trades Club, New York, Dec. 12. W. J. Kreger, 261 Broadway.

American Physical Society—University of Cincinnati, Cincinnati, Dec. 27-29. H. W. Webb, Columbia University, New York City.

American Engineering Council (F. A. E. S.)—Washington, Jan. 10-11. L. W. Wallace, 26 Jackson Place, Washington.

Kentucky Association of Public Utilities—Louisville, Jan. 10-11. E. F. Kelly, Louisville Railway Company.

Wisconsin State Association of Electrical Contractors and Dealers—Pfister Hotel, Milwaukee, Jan. 17-19. H. M. Northrup, 23 Erie Street, Milwaukee.

Western Association of Electrical Inspectors—Hotel Fontenelle, Omaha, Jan. 29-31. W. S. Boyd, 175 West Jackson Blvd., Chicago.

American Institute of Electrical Engineers—Midwinter convention, Bellevue-Stratford Hotel, Philadelphia, Feb. 4-8. F. L. Hutchinson, 33 West 39th St., New York.

Recent Court Decisions

Restrictions on Collection of Trade Statistics.—By a decision just handed down by the United States Court of the Southern District of Ohio in a suit brought by the Department of Justice against the Tile Manufacturers' Credit Association the collection of trade statistics by a manufacturers' association is virtually limited to those which may be requested by governmental agencies. This decision, which may prove of far-reaching importance to manufacturing associations in all lines of industry, is printed in full in the "Manufacturing and Markets" section of this issue, page 1195.

Confiscation and Contracts.—In reversing a decree of the Supreme Court of Georgia affecting interurban railway fares (Georgia Railway & Power Company vs. Town of Decatur) the United States Supreme Court made the following observation: "In deciding the constitutional questions presented this court will determine for itself whether there is in fact a contract and, if so, the extent of its binding obligations, but will lean to an agreement with the state court. . . . We see no reason to differ with that court in its view of the validity and binding quality of the contract. The contract being valid, we are not concerned with the question whether the stipulated rates are confiscatory."

Contract Providing Free Lighting to Municipality Rightly Set Aside.—The Supreme Court of Utah has handed down a decision sustaining the Utah Public Utilities Commission in setting aside a contract between the Dixie Power Company and the city of St. George by which free street-lighting service for twenty-five years was granted as part payment for the municipal power plant, conveyed to the company's predecessor. In lieu of the contract the commission allowed the city a credit of $9,907, and this arrangement is ratified by the Supreme Court. The court held that the Legislature of Utah had never surrendered its police power, which in the public utilities act it had delegated to the commission. "The purpose of that act," said the decision, "is to require all those who are similarly situated to pay the same rate for public utility service, to the end that all shall share the burdens of such service equally, and to deter public utilities from practicing favoritism. Take this case as an example. If under plaintiff's contract which it seeks to have enforced it would obtain electrical energy for less than it costs to develop and to distribute it to the plaintiff, then other cities and communities which are less fortunately situated would necessarily have to pay for what the plaintiff receives free. While such a result often arises under ordinary contracts, it cannot be tolerated under contracts for public utility service in view of the provisions of the public utilities act. It is for that reason the public utilities acts are held not to be subject to existing contracts except where the sovereign has expressly or by unavoidable implication surrendered its right to interfere with existing contracts. That, as we have seen, is not the case in this jurisdiction."

Wisconsin Supreme Court Holds that Commission Has Jurisdiction Over Meter Tampering.—The Supreme Court of Wisconsin has reversed the decision of the municipal and circuit courts of Kenosha County in the case of two customers of the Wisconsin Gas & Electric Company accused of tampering with their meters. The Supreme Court holds that jurisdiction belongs to the Wisconsin Railroad Commission and not to the courts. By this decision the company will be able to discontinue service where a meter has been tampered with and to refuse to reconnect until a settlement is made. The patron may then pay under protest and carry his case to the commission. In the suit just decided a bill for back service amounting to $750 was rendered and when the alleged offenders refused to pay service was discontinued. The customers of the company brought suit and obtained an injunction to prevent the company from discontinuing service, the lower courts holding that the company could not refuse service until it had gone into the courts and established the amount due.

Power Company and Seller of Right to Overflow Land Jointly Responsible for Damages to Timber Owned by Another.—In an action (Price vs. Ketchum) brought to recover damages for the destruction of timber owned by the plaintiff because of the erection of a dam by the Georgia-Alabama Power Company it was brought out that Ketchum after selling timber on his land to Price, allowing him five years to remove it, had prior to the expiration of that period executed an instrument giving the power company the right to overflow the land, which had been done, destroying the timber. The Court of Appeals of Georgia found that Ketchum and the power company were properly joined as co-defendants in the action inasmuch as Ketchum could not sell the plaintiff the timber and then sell to some one else the right to destroy the timber, while the power company on its part, knowing as it did that the timber belonged to the plaintiff, could not without purchasing or condemning the property overflow the land and destroy the plaintiff's possession. The rights of Price, a party in interest, were not met by an agreement when he received his deed to the timber that in certain contingencies the price would be lessened. (119 S. E. 442.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Length of Notice of Discontinuance of Service.—While otherwise approving a contract between the city of Tipton and the Northern Indiana Power Company to purchase energy for the Tipton Electric Light Company, the Indiana Public Service Commission modified one of its provisions by insisting that before discontinuance of service for nonpayment of bill written notice to the delinquent customer should be given ten days previous to discontinuance instead of forty-eight hours.

Amortization of Excess Purchase Price.—In authorizing the sale of the gas property of the Watts Engineering Company to the Public Service Company of Missouri, the Missouri Public Service Commission, which observed that some consideration must be given to current prices in fixing the fair value of utility property for the purpose of ascertaining a proper sale price and a proper basis for securities, declared further that the transfer of utility property at a sale price in excess of the fair value should be authorized only on condition that the excess price be amortized out of net income available for return, surplus and contingencies, and that no portion of such excess should be charged to the operating expenses or to capital account.

Summer Resort Schedules.—In adjusting complaints made by summer resort customers of the Indiana & Michigan Electric Company, the Michigan Public Utilities Commission, as previously reported, said that the fact that a consumer guarantees by an advance payment for the summer season a certain fixed amount for electric service does not justify a utility in giving that consumer a lower kilowatt-hour rate than a consumer who does not guarantee the company as large an advance payment. The commission went on to say that an optional summer resort schedule should be effective over a definite period and should be available to consumers only during that definite period, where a large number of the utility's summer resort customers desire an optional schedule to relieve them of minimum bills during winter months. Summer resort customers should make advance payment before service is rendered under such a schedule, the rate per kilowatt-hour should be on a per season basis, and no bills should be rendered to consumers who are served under the optional season rate schedule until the amount advanced by such consumers has been exceeded, based upon the kilowatt-hour rate. No charge should be made by an electric utility for connecting or disconnecting summer resort service under an optional schedule under which an advance payment is required.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

T. W. Martin Heads Southeastern Division of N. E. L. A.

Thomas W. Martin, president of the Alabama Power Company for the past three years, was elected president of the Southeastern Division of the National Electric Light Association at the convention held recently in Tampa, Fla. Mr. Martin has been in charge of legal work for the Alabama Power Company and associated companies since 1912 and three years later was appointed its vice-president and general counsel. It was in 1920, when James Mitchell resigned the presidency to become chairman of the board of directors, that Mr. Martin was elected to the office he occupies at the present time. In addition, he is president of the Alabama Traction, Light & Power Company and vice-president of the Alabama Interstate Power Company, the Alabama Power & Light Company and the Birmingham, Montgomery & Gulf Power Company. Mr. Martin is a native of Alabama and a graduate of the law department of the University of Alabama.

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T. W. MARTIN

M. J. Zurick, formerly associated with the West Penn Power Company at Charleroi, Pa., has assumed the duties of division manager of the Brooke Electric Company, Wellsburg, W. Va., a constituent of the West Penn system.

Samuel T. MacQuarrie has been appointed director of the New England Bureau of Public Service Information, with headquarters in Boston. Mr. MacQuarrie has been associated with the banking house of Curtis & Sanger, Boston, and for about twenty years was employed by the Fore River Shipbuilding Corporation at Quincy, Mass., and later by the succeeding Bethlehem Shipbuilding Corporation, Ltd., as assistant to the works manager and in charge of publicity prior to the Bethlehem acquisition.

E. H. Hubert, formerly associate editor of the *Industrial Engineer*, has become attached to the headquarters staff of the American Institute of Electrical Engineers. He will act as the secretary of the meetings and papers committee and be connected with the work of the technical committees and Institute sections. Graduating from the Georgia School of Technology in 1912, Mr. Hubert was connected with the engineering department of the Georgia Railway & Power Company for four years. Later he became an assistant editor of the ELECTRICAL WORLD, and for the past two years he has been in charge of the New York office of the *Industrial Engineer*.

Emmet N. Britton, for the past two years assistant to the general manager of the San Joaquin Light & Power Company, Fresno, Cal., has resigned to join the King-Knight Company, which does a general manufacturers' agency and engineering business in San Francisco. Before assuming the duties of the office he has just resigned he was managing editor of the *Journal of Electricity*. Mr. Britton, who is a native Californian and a graduate of the University of California, is the son of the late John A. Britton.

Mortimer E. Cooley, dean of the engineering schools of the University of Michigan and retiring president of the Federated American Engineering Societies, was the guest of honor at a dinner given in Detroit on Nov. 23 under the auspices of the Detroit Engineering Society, the Detroit Section of the American Society of Civil Engineers, the Detroit Section of the American Society of Mechanical Engineers and the Detroit-Ann Arbor Section of the American Institute of Electrical Engineers. Hundreds of engineers and representatives of other callings attended.

Joseph B. Groce, director of the New England Bureau of Public Service Information, Boston, has resigned to join the staff of the Edison Electric Illuminating Company of Boston, with headquarters at the executive offices. He will devote himself to public relations in his new post, reporting to the president. Mr. Groce was formerly engaged in public relations work with the Bethlehem Shipbuilding Corporation, Ltd., at Fore River, Mass., and in August, 1922, was appointed the first director of the newly formed New England bureau, where he has rendered distinguished service to the public utility industries.

F. R. Low Takes Office as President of A. S. M. E.

Frederick Rollins Low, since 1888 editor of *Power*, a McGraw-Hill publication, was inducted as president of the American Society of Mechanical Engineers at the convention held this week in New York. He is a native of Chelsea, Mass., and for seven years previous to assuming editorial duties on *Power* he was with the Boston *Journal of Commerce*. Mr. Low is an inventor of some note, having to his credit in this field an arc indicator, a cleaner for vertical tubular boilers, a shaft-leveling target, an elevator control and a rotary engine which were developed by the Clark & Low Machine Company. He is the author of "The Power Catechism," "The Compound Engine," "Condensers" and "The Steam Engine Indicator." Mr. Low has been active in the American Society of Mechanical Engineers since becoming a member in 1886. He served as its vice-president in 1918 and was when elected president a member of the council, of the boiler code committee and chairman of the power test committee, the largest committee of the society. He will be the association's delegate to the World Power Conference in London. Mr. Low is a member of many other engineering societies, including the National Association of Stationary Engineers, American Society for Testing Materials, American Society for the Advancement of Science, the Engineers' Club of New York and the Engineers' Club of Boston.

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F. R. LOW

J. M. Barry, who was made manager of the southern division of the Alabama Power Company early this year, has been appointed manager of retail operations, with headquarters at Birmingham. Mr. Barry has been associated with the Alabama company since 1919, when he was placed in charge of the eastern division. Two years later he was made assistant chief engineer, which position he occupied until his promotion to the office of manager of the southern division.

Colonel Saltzman to Succeed General Squier

Colonel Charles McKinley Saltzman, senior colonel of the Signal Corps, has been named to succeed Major-General George O. Squier, chief signal officer of the army, who will retire on Dec. 31 after forty years of service. General Squier entered the service in 1883 after being graduated from West Point and has won distinction in the army as an electrical engineer and scientist, especially in radio development. Colonel Saltzman has been associated with the Signal Corps since 1901.

George Drake Smith, formerly sales manager of the Steinmetz Electric Motor Car Corporation, has been elected president of the Delmore Motors Corporation, New York.

R. C. Harvey, who has been associated with the Adirondack Power & Light Corporation, Schenectady, N. Y., for the past two years, has resigned to join Henry L. Doherty & Company of New York. Mr. Harvey will be stationed temporarily in Denver, where he will engage in the promotion of customer ownership of utilities.

K. F. Green, who for many years has been superintendent in charge of properties and operation of the Wisconsin River Power Company's hydro-electric power plant in Prairie du Sac, Wis., has been transferred to the Madison office of the Wisconsin Power, Light & Heat Company.

Ralph E. Dodson, formerly associated with the Louis A. Roberg Company, consulting engineers, Cincinnati, has entered the service division of the Westinghouse Electric & Manufacturing Company in that city. Mr. Dodson was previously associated with the Westinghouse company.

Fred H. Dorner, consulting engineer of Milwaukee, was recently elected president of the Engineers' Society of Milwaukee. Before forming the consulting engineering organization of which he is now head, Mr. Dorner was associated with the Bailey Manufacturing Company as chief engineer and sales manager, and he was previously with various departments of the Allis-Chalmers Manufacturing Company. He has been secretary of the Engineers' Society of Milwaukee for ten consecutive years.

C. B. Barnett is now superintendent of the municipal electric light plant at Huntersville, N. C., succeeding R. E. McDonald.

Sydney Whitmore Ashe, director of the educational and welfare department of the Pittsfield works of the General Electric Company, has been elected chairman of the employees' house organ section of the National Safety Council. Mr. Ashe is a graduate of the Brooklyn Polytechnic Institute and has had an extensive experience in the teaching of electrical engineering, in technical writing and in safety work. He is also editor of *Current News,* published by the Pittsfield works for the benefit of employees. His writings on accident prevention have been adopted for the university extension course of the State of Massachusetts as the principal reading text in the curriculum.

G. W. Partridge, British Inventor-Engineer

G. W. Partridge, managing director and engineer of the London Electric Supply Corporation, Ltd., commenced his professional career at the Hammond Electrical Engineering College, London, and later served in the workshops of Woodhouse & Rawson and the Anglo-American Brush Company of London. In 1888 he joined the engineering staff of the Grosvenor Gallery Supply, which organization later became the London Electric Supply Corporation. In this undertaking he became associated with Dr. Ferrenti in experimental and erection work, including the manufacture of transformers, meters, cables and electric generators in connection with the corporation's 10,000-volt power station at Deptford. When Dr. Ferrenti severed his connection with the corporation thirty-two years ago, Mr. Partridge became chief electrical engineer, and the responsibility for the development of the 10,000-volt alternating-current system, at that time singularly novel, devolved on him. In 1900 he was appointed engineer in chief and later engineer and manager, and in 1920 he entered upon the office he occupies at the present time.

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G. W. PARTRIDGE

Mr. Partridge has invented and patented many useful improvements in electrical machinery, including in 1892 the oil switch for alternating-current control now in universal use, a fuse, a grounding device and a pressure detector. He is a past-president of the Old Students' Association of the Faraday House Electrical Engineering College, originally the Hammond Engineering College, and has served on the council and many committees of the Institution of Electrical Engineers and as its vice-president in 1917. For many years past he has been engrossed in the problem of unifying the electric supply of London and is at present one of the engineers engaged in reorganizing and consolidating the numerous interests and power stations in the London area.

J. F. McCortney is now president of the municipal electric light plant at Bromide, Okla., succeeding W. O. Kitt.

V. O. Stafford, formerly commercial manager of the Northern Iowa Gas & Electric Company, Humboldt, Iowa, has been made manager of the securities department of the company.

A. C. Jones, formerly manager of the Clarion division of the Northern Iowa Gas & Electric Company, has been made commercial manager of the company, succeeding V. O. Stafford.

C. G. Bentley, formerly vice-president of the Ravenna (Ohio) Gas & Electric Light Company, has been made president of the company to succeed H. Wurdack. E. G. Crawford is now vice-president and secretary.

Frank A. Short, formerly electrical engineer of the State Accident Commission of California, is now connected with the Safety Electric Products Company of Los Angeles as a consulting and advisory engineer.

E. L. Booth, for thirteen years associated with the Edison Electric Illuminating Company of Boston in the sales department and also as district manager, has recently joined the Los Angeles office of the Western Electric Company as specialty appliance salesman in the supply division.

J. L. McQuarrie, assistant chief engineer of the International Western Electric Company, left New York on Saturday, Nov. 24, for Tokyo, Japan, where he will aid in the solution of Japan's telephone problem. The earthquake destroyed sixteen telephone exchanges and 82,000 telephone lines. Mr. McQuarrie will consult with officials of the Nippon Electric Company, a firm associated with the International Western Electric.

Percy H. Thomas of New York City will resume his practice as a consulting engineer on Jan. 1. As consulting electrical engineer for Guggenheim Brothers he has had charge for some years past of the power department of their engineering organization, which has developed the copper properties of the firm in Chile. He acted also as consulting and designing engineer for the Maitenes hydro-electric power station and the 110,000-volt transmission lines of the Compañia Chilena de Electricidad, Ltda., a large electric utility of central Chile controlled by English interests. Mr. Thomas collaborated in a consulting capacity with W. S. Murray in his study under government auspices of a superpower system for the region between Boston and Washington. He has contributed many valuable articles and papers on transmission to the technical press and the American Institute of Electrical Engineers.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Court Order Restricts Gathering of Trade Statistics

Decree of United States District Court in Ohio Dissolves Tile Manufacturers' Credit Association Under Provisions of Sherman Anti-Trust Law

COLLECTION of trade statistics is virtually limited to those which may be requested by a governmental agency in the final decree in the case brought by the Department of Justice against the Tile Manufacturers' Credit Association. The proceeding was in the United States Court of the Southern District of Ohio.

Before the decree was made final the law department of the National Association of Manufacturers urged the Department of Justice to permit the periodic collection of facts relating to capital employed, power used, wages, taxes paid, fuel consumed and machinery employed, in addition to production, sales, shipments, stocks, prices and like pertinent trade information. It was specified that all such information was to be a record of accomplished facts.

Decision of Far-Reaching Effect Upon Trade Associations

It is known that the Department of Justice gave long and careful consideration to the proposal. The significance of the decree is increased greatly by the fact that the collection of trade statistics is not made permissible after the department's study of the proposal. It is anticipated that this decree will have a far-reaching effect upon trade associations. Its provisions follow in full:

1. That the combination and conspiracy in restraint of interstate trade and commerce, the acts, regulations, rules, resolutions, agreements, contracts and understandings in restraint of interstate trade and commerce as described in the petition herein, and the restraint of such trade and commerce obtained thereby, are violative of the act of Congress of July 2, 1890, entitled "An act to protect trade and commerce against unlawful restraints and monopolies," known as the Sherman anti-trust act.

2. That the contract of association dated April 24, 1917, between the defendant tile manufacturers, under which the defendant Tile Manufacturers' Credit Association is organized, is a contract in restraint of interstate trade and commerce in violation of the aforesaid act of Congress, and the Tile Manufacturers' Credit Association is in and of itself a combination in restraint of such trade and commerce and an unlawful instrumentality organized, operated and maintained for the purpose of carrying into effect the combination and conspiracy described in the petition herein and constitutes a violation of said act of Congress.

3. That the defendants and their officers, agents, servants and employees, and all persons acting under, by or in behalf of them or any of them, be and they are hereby perpetually enjoined, restrained and prohibited from combining, conspiring or agreeing, expressly or impliedly, directly or indirectly, through any collective agency or agencies, or directly between themselves or any of them, to make or receive any or all of the reports described in the petition herein, or to collect and distribute the information or any part thereof specified in said reports, or either or any of them, or to make or receive any reports having the same general character or the same purpose and effect as said reports, or to collect and distribute information similar to that specified in said reports, or any part thereof.

Provided, however, that the defendants may, through the association or corporation hereinafter provided for, receive and compile for transmission to any governmental agency such information and statistics as it may request as to the production, shipments, the stocks on hand and the price of tiles, but are restrained from distributing said information among themselves, except that information respecting sales may be collected annually and used to enable the assessment of the several members for their proportionate parts of the several expenses of the association, and for no other purpose.

4. That the defendants and their officers, agents, servants and employees, and all persons acting under, by or in behalf of them, or any of them, or claiming so to act, be and they are hereby ordered and directed to dissolve and to forever discontinue defendant Tile Manufacturers' Credit Association, and that they be and they are hereby perpetually enjoined, restrained and prohibited from directly or indirectly engaging in or forming any like association, from making any express or implied agreement of association or arrangement similar to or like said agreement or arrangement, from carrying out or continuing in effect the contracts and agreements described in the petition herein, from making any express or implied contracts, agreements or arrangements similar thereto, and from using any other means or methods having the purpose or effect of restricting or restraining interstate trade and commerce in tiles.

Objects Permitted

Provided, however, that the defendants are not restrained or enjoined from maintaining an association, either voluntary or incorporated, for the following objects and purposes and none other:

(a) To advance or promote the use of tiles by research, publicity, advertisement and similar activities.

(b) To deal with engineering and trade problems for the purpose of advancing the manufacture and use of tiles and to secure the arbitration of trade disputes.

(c) To carry on educational work pertinent to the industry through fellowships in schools and colleges and experimental and research work and the instruction of mechanics and training of apprentices and workmen, and to provide for scientific research, lectures and the writing, reading and publication of papers on subjects pertaining to the industry.

(d) To maintain a traffic bureau to assist the industry in transportation matters before federal and state commissions and other bodies concerned in questions of transportation and tariff and also with common carriers, and, upon request of any member of the association, to furnish such member any information relating to rates upon its products or rules of transportation that may be contained in any public schedule or tariff, but all rates furnished shall be the actual rates between points of shipment and delivery and shall not be based on any fixed or basing point.

(e) To improve sanitation, safety appliances, working conditions, accident prevention, employment, housing conditions, insurance and matters of like character.

(f) To handle the insurance of its members, including fire, industrial, indemnity or group insurance.

(g) To maintain a credit bureau for the sole purpose of furnishing upon specific requests information as to the financial standing and the credit rating of persons and corporations purchasing or attempting to purchase tiles, but not to create directly or by inference a list or class of so-called legitimate or preferred dealers or purchasers. The gathering of information

solely for the purpose of providing credit information on special request shall not be considered a violation of any part of this decree.

(h) To secure and maintain the standardization of quality and of technical and scientific terms and the elimination of non-essential types, sizes, styles or grades of products.

OBJECTS PROHIBITED

5. That the defendants, their officers, agents, servants and employees, and all persons acting under, through or in behalf of them or any of them, be and they are hereby perpetually enjoined, restrained and prohibited from combining, conspiring or agreeing, expressly or impliedly, directly or indirectly to do any of the following acts:

(a) To adopt or use a uniform basic price list, or to fix and adopt list prices for their products.

(b) To establish or maintain uniform prices for their products.

(c) To establish and maintain individual prices that are uniform for all classes of purchasers or dealers and for all sales.

(d) To establish or maintain rules or regulations as to the acceptance of orders at prices in effect prior to changes therein.

(e) To establish or maintain uniform extra charges for built-up letters, for numbers or for beveled edges.

(f) To establish or maintain uniform limitations on the proportionate amounts of the lower grades of tile sold.

(g) To sell tiles f.o.b. factory with freight equalized with other factories in the United States manufacturing the same class of tiles.

(h) To compile and distribute freight rate books for use in making freight equalizations.

(i) To establish or maintain uniform terms of sale.

(j) To establish or maintain uniform conditions or for the acceptance of orders.

(k) To establish or maintain uniform charges for barrels, half barrels or boxes used for shipping tiles; to refuse to allow credit for old packages returned, to quote prices with package charges included, and to charge for packages whether used in shipment or not.

(l) To establish or maintain uniform conditions for the furnishing of tiles for sample purposes.

(m) To refuse to combine less than carload shipments into carload shipments invoiced to one of the purchasers.

(n) To refuse to sell to any persons or corporations because of any unpaid account or accounts.

(o) To formulate and establish or to retain in effect any requirements, circumstances or conditions non-conformity or non-compliance with which shall exclude any customer or customers from securing credit or shall impose any limitations or conditions whatsoever upon the credit granted.

(p) To restrict sales to dealers or contractors in tile or to establish uniform requirements for classification as dealers or contractors.

(q) To establish any system of co-operative purchasing of raw materials or supplies, or of co-operative owning of the sources of raw materials, which shall eliminate or tend to eliminate competition in the purchasing of said materials or supplies.

(r) To adopt or to use a common trademark.

(s) To pool orders or to enter joint bids.

(t) To prepare and publish any list or lists of dealers or of certified dealers.

(u) To advise or communicate with one another as to proposed advances or decreases in prices or to circulate among themselves in any way information concerning or relating to proposed advances or decreases in prices, or to prices charged or to be charged.

(v) To effect in any manner whatsoever any discrimination of any character in favor of or against any individual or corporation purchasing or attempting to purchase tiles, by reason of the fact that such person or corporation is a mail-order house, or a dealer in other supplies or commodities or a co-operative purchasing association, or a building contractor, or for any other reason, or to do any act or acts to effectuate any discrimination in favor of or against any person or corporation for any reason whatsoever.

Provided, however, that nothing contained in this decree shall be construed as prohibiting any defendant from doing or performing any of the foregoing acts or from selecting his or its own trade and from disposing of his or its own products to such persons and on such terms as he or it may choose, if done individually and without combining, conspiring or agreeing with any other defendant or with any other manufacturer of tiles or other person.

Overemphasizing the Jobber's Stock

BY A SALES MANAGER

IT IS needless to emphasize the value of a well-maintained jobber's stock in electrical merchandise and supply distribution, but it is a mistake to overemphasize this portion of the wholesaler's service to the industry. The place of the jobber has been discussed so often that it is difficult to write anything new about it, and yet I have encountered so much complaint about the jobber's present hand-to-mouth buying as I have talked with manufacturers within the past few weeks that I am moved to say a few words on this subject. They will be few, too.

Some people do not seem to realize that if the jobber overstocks some one must pay the cost of his mistaken judgment. We hear a lot of talk just now about the jobber's acting merely as a broker in the sale of supplies, with the conclusion that this is a service of little value. Is there any doubt that the jobber performs a truly valuable service by acting as a clearing station for orders? Is there any question that the manufacturer would be "up against" a very hard situation if he should lose the contact with the local trade which the legitimate jobber maintains? Who is going to pass upon the credit situations of would-be purchasers of materials and who can size up the character and business of the retailer in the way the distributor can in his own general neighborhood? It would be ridiculous for the manufacturer to undertake this activity. Think of the staff he would require to maintain the contact the jobber does with the local industry! Where would the cost of distribution go without the jobber's service?

Who can blame the jobber for not buying more supplies than he can sell within a reasonable period? It is admitted that the jobber should carry a stock equal to meeting reasonable fluctuations in demand; but if the manufacturer's enthusiasm for his product leads to overproduction is the jobber to blame? I wonder if a lot of good might not be accomplished if a little more horse sense could be used in estimating the market for the coming six months by jobber and manufacturer together, rather than slavish adherence by the manufacturer to the mass-production idea, with its possibilities of undigested accumulations of material which somebody must pay for in overhead.

The real jobber is doing the industry a vast amount of good by helping the contractor-dealers and other purchasers to buy intelligently, to use good business methods in running their establishments and to spread abroad co-operative ideas. I will go so far as to say that under such conditions of active demand as now prevail the maintenance of surplus stock is less important and less valuable to the industry than the jobber's service as a go-between between the retailer and the manufacturer. In the combination of orders, in co-ordinating selections, in following deliveries, in watching credits and in educating the less well informed, the jobber is performing a service that in my opinion gives him an impregnable place in the industry.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

THE usual pre-inventory conservatism began to manifest itself last week generally throughout the country, jobbers instituting the policy of buying in the smallest possible orders and sacrificing the quantity discounts to hold down stocks to the minimum and reduce the burden and expense of inventory taking. The Christmas demand is still booming along, and manufacturers of appliances are busily engaged in turning out rush orders.

The price of wire, cable and reinforced cord has shown slight increases in the East and on the coast. Motor sales in New England are reported 40 per cent higher than last year. General business is excellent with central-station outputs increasing steadily at higher rates. Increased activity in the garment trades in New York has influenced a growing demand for second-hand motors in this city. A general spirit of optimism prevails throughout the Southeast owing to crop conditions. Collections have improved there, and the demand for electrical material is unusually heavy. In Chicago purchases of lighting equipment, radio and appliances have been very heavy. Building activities also continue, and wiring devices, conduit and kindred lines are running strong. Pole-line hardware and central-station equipment show a steady market, and in the pole country labor conditions give promise of good production.

Porcelain Makers Recover Market; Stocks Well Balanced

BUSINESS in porcelain products has picked up considerably during the last three weeks. According to the jobbing and manufacturing authorities, increased activity in old-house wiring in the Eastern districts of the country and extensions to telephone lines both in the Eastern and Southern districts have done much to bring about prosperity in this field after a sluggish market of almost six months' duration. During the early part of the summer deliveries to manufacturers of high-tension equipment in the Chicago district were very slow as it was a continual struggle to keep up with the demand caused by unusually heavy purchases of central-station line material and equipment. Labor troubles, coupled with increasing difficulty in securing primary raw materials, caused the most serious trouble in production experienced for some time in this industry.

A little more than two months ago, when manufacturing facilities had begun to improve and when stocks were more plentiful, a slump in building operations and a short let-up in the activities of the central-station and telephone companies caused another bit of hardship among the porcelain manufacturers and sellers. A leading authority, commenting on the general condition last week, stated that conditions have been much improved by well-balanced stocks and an even demand from all sections of the country. Another feature of the present market is said to be the fact that wiring-device manufacturers during the last few months have been buying more porcelain parts.

Manufacturers of special porcelain report that the increasing business being done by the heating appliance and automotive spark-plug makers is holding up their orders to a rate exceeding any year since 1919. In this field the demand is for machine-turned products, and there is little interest shown by even the smallest manufacturer of appliances in poor-grade porcelain. It is pointed out that one may find many appliances on the market fitted with cheap heating elements, low-grade standards, but very few firms disregard the value of high-grade porcelain.

Set 192,000,000 Figure for Type "B" Lamps Produced in 1923

INFORMATION received from one of the leading authorities in the lamp-manufacturing industry during the last week is to the effect that 192,000,000 type "B" lamps were produced during the year 1923. According to this estimate, 48,000,000 type "C," 1,000,000 carbon and 100,000,000 miniature lamps were also produced during this year. These figures compare with production figures of lamps during the years 1922, 1921 and 1920 as follows:

	1923	1922	1921	1920
Type "B"	192,000,000	165,000,000	134,000,000	172,000,000
Type "C"	48,000,000	40,000,000	27,000,000	43,000,000
Carbon	1,000,000	5,000,000	7,000,000	15,000,000
Miniature	100,000,000	95,000,000	105,000,000	105,000,000
Total	341,000,000	305,000,000	273,000,000	335,000,000

Value of Delinquent Electrical Accounts Increased in October

ALTHOUGH the number and total value of delinquent accounts have increased in three of the five territories reporting to the National Electrical Credit Association, the average amount increased from September, 1923, to October, 1923, in only one territory—that of New York. In general the number of accounts delinquent in October, 1923, was more than for the same period in 1922.

In the four territorial divisions the total amounts in this same period increased. The central division still leads, with 981 accounts reported for October, 1923, against 760 for September, 1923, when the average amounts were $109.74 and $125.33 respectively. In Philadelphia the gain in accounts in October, 1923, over September, 1923, numbered eighty, although the average amount decreased to $99.84 for October.

DELINQUENT ACCOUNTS IN OCTOBER

Branch and Month	Number of Delinquent Accounts Reported	Total Amount	Average Amount
Central Division:			
Sept., 1922	882	$98,818.90	$112.04
Sept., 1923	760	95,252.94	125.33
Oct., 1922	872	102,465.56	117.50
Oct., 1923	981	117,653.05	109.74
New York:			
Sept., 1922	530	78,739.00	149.00
Sept., 1923	365	61,731.00	169.00
Oct., 1922	517	59,602.00	115.00
Oct., 1923	442	77,479.00	175.00
Philadelphia:			
Sept., 1922	264	39,060.19	147.96
Sept., 1923	246	27,955.15	113.64
Oct., 1922	262	24,609.19	93.93
Oct., 1923	326	32,547.98	99.84
New England:			
Sept., 1922	124	13,045.43	105.20
Sept., 1923	56	8,156.49	145.65
Oct., 1922	80	11,223.14	140.29
Oct., 1923	51	3,808.88	74.68
Pacific Coast:			
Sept., 1922	19	3,002.57	157.95
Sept., 1923	26	6,998.20	269.16
Oct., 1922	22	3,980.61	180.50
Oct., 1923	23	5,804.78	252.38

Appliance Sales Speeding Chicago Market; Active Construction

HOLIDAY buying is increasing sales for the electrical trade, and purchases of lighting equipment, radio and appliances for gifts have been of great volume. Considerable emphasis is laid on the idea of giving these kinds of gifts this year. The building activity is continuing, and the demand for wiring devices, conduit, etc., remains exceptionally good for this time of the year. Much of this work is being rushed to completion before snowfall.

Rubber-covered wire is the same this week, despite the fact that cotton spot is about 38 cents. There were, however, some reductions made in the prices of lamp cords and portable cords. One manufacturer readjusted his price list, effective Dec. 26, with a reduction on these items. He also discontinued the manufacture of pure silk cords, making only the art silk. There has been a reduction in the price of street-lighting glassware. The new figures quoted include the packing charges. This reduction is made to obtain more action.

Pole-line hardware and central-station equipment purchases remain steady, with no changes in either price or supply. Pole producers representing about 27 per cent of the log output have now on hand 85 per cent of their labor requirements. This compares favorably

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0354	$0.0354	$0.0304
Cold finished shafting, per lb.	0.0465	0.0465	0.039
Brass rods, per lb.	0.155	0.1525	0.17
Solder (half and half), per lb.	0.325	0.295	0.265
Cotton waste, per lb.	.10 to .13	.10 to .13	.09 to .11½
Washers, cast iron (⅛-in.), per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.38	3.38	3.02
Machine oil, per gal.	0.297	0.297	0.33
Belting, leather, medium, off list	30–10%	30–10%	40–5%
Machine bolts, up to 1-in. x 30-in., off list	45%	40–10%	40%

with conditions last year, when only 60 per cent of the necessary men were available.

Weatherproof Wire Firmer in New England

HIGHER prices on the smaller sizes of weatherproof wire by about ⅛ cent a pound, base, were a feature of the market at Boston Monday, with other prices showing little change. Jobbers report a steady volume of orders in many lines, with cautious buying by them as the inventory period approaches. Appliance manufacturers in New England are extremely busy on pre-holiday production. Deliveries are excellent, although some delay on shipments from the Middle West is reported on the railroads.

Motor sales in the Northeast are running about 40 per cent above last year's in dollars. There is still some slack to be taken up during the next few days in retail heavy-appliance sales, but the outlook is good for the month. Lamps are moving at record-breaking rates.

General business in New England continues excellent, barring spotty conditions in cotton-textile manufacture and uncertain labor conditions in the leather industry. Building contracts are holding up well, with every prospect of substantial expansion next spring.

New York Market Is Strong; Jobbers' Buying Conservative

NEW YORK'S electrical market continues strong in all business relating to the holiday buying, but there is a slight tendency on the part of the jobbers to order in more conservative amounts in face of the approaching inventory period. During the week a slight marking up in code wire and lamp cord was noted. This advance is thought due to the increasing strength of the copper market during the last few weeks.

Second-hand-machinery dealers are enjoying excellent business due to the increased activity in the garment-making section and among the industrial plants of the city, which are calling for extra motors for special and short-time work. Motor manufacturers report production at a high rate, but sales are rather slow, in keeping with this time of the year.

Record-breaking amounts of Christmas-tree lighting outfits were sold in the dealers' stores during the last week. An interesting feature of this market is the apparent fact that many more people are beginning to realize that those Christmas-tree lamps bought in the lower-priced stores are of too short life, and consequently sales in the department and five-and-ten-cent stores are not great for this year.

Southeast Has Unusual Demand for Building Equipment

A GENERAL spirit of optimism prevails throughout the Southeastern territory. Good weather for harvesting crops and the high price of cotton have considerably improved the tone in the rural sections, and business in the towns is very satisfactory. Credit men report November collections as being good and showing some improvement over October.

Jobbers state that the demand for electrical building material is unusually heavy for this period of the year, and November building permits in Atlanta, which amounted to $1,889,264, would seem to indicate that the movement will hold up for some time to come. Lighting fixtures are going well, with the better-class residential type the most in demand. Jobbers' stocks are ample and no price changes are reported.

Retail business in Atlanta is looking up, and present indications are that the holiday buying will be well under way in another week. Christmas-tree outfits and toy trains are the only specialties that the majority of dealers are handling, but satisfactory stocks are on hand. Heating-device sales are going steadily, and this season will no doubt set a new high record.

Devices Selling Actively Along West Coast; Wire Advances

MANUFACTURERS maintaining San Francisco schedule material stocks for delivery along the West Coast report a remarkable increase in business in Seattle, Spokane and Portland. Among the best sellers are brass sockets and push and toggle switches. Candle sockets are selling specially well, and a competitive market is reflected in the present price of $10.15 per 100 for standard packages of the most popular style. Rubber-covered wire has advanced almost 5 per cent, and No. 14 S.B. solid is selling at about $7.40 per 1,000 ft. in 25,000-ft. assorted orders.

Range sales are good and fairly well distributed. An excellent holiday season is anticipated in the belief that the caution and economy shown by the average consumer all during the year have improved general purchasing power.

Caution in St. Louis Buying; Prices Continue Fairly Steady

NO SHARP improvements have developed in general business conditions in St. Louis electrical circles during the month of November as compared with the month of October. Irregularity continues, good business and fair activity being indicated in certain lines, while in others there has been a decided tendency to slow down. Purchases are being made on an extremely cautious and conservative basis. The total volume of business has been fair, but individual orders for the most part have been small.

Orders for radio sets, portable lamps and domestic appliances have been stimulated by the approach of the holiday season. The demand for special wiring devices has fallen off to some extent, and there is the usual seasonal slowing down in outside construction work by the utilities. Manufacturers report a splendid demand for motors, especially in smaller sizes, while the demand for battery-charging apparatus has taken a decided slump.

With the exception of a slight reduction in the prices of bare and insulated copper wire and cables, transformers and lighting fixtures, prices in general continue fairly steady on staples. Stocks are reported to be normal, except for a slight shortage in certain sizes of electric heaters and in some types of radio sets.

The Metal Market

THE copper market is firmly established at 13.25 cents per pound delivered. Rather important transactions were closed at that figure during the week, and the fact that big consumers who had been attempting to get concessions placed contracts at the 13.25-cent price leads to the belief that no large amount of the metal could be obtained at a lower figure. Inquiries are coming into the market again, and while there are no indications that the sales in the current month will reach the large total of November, it is believed in the trade that the volume will be comparatively good.

Export sales continue only moderate, but there is no price shading and the larger interests are getting the bulk of the business from abroad, indicating that all interests are holding to the regular quotations. Lead, zinc and tin continue at firm prices.

NEW YORK METAL MARKET PRICES

	Nov. 27, 1923 Cents per Pound	Dec. 6, 1923 Cents per Pound
Copper, electrolytic	12.62½	13.25
Lead, Am. S. & R. price	6.85	6.85
Antimony	9.25	9.25
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6.25	6.25
Tin, Straits	43.00	43.00
Aluminum, 98 to 99 per cent.	26.00 to 27.00	26.00 to 27.00

Activities of the Trade

Devoted to News of the
Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Electric Storage Battery Growth

Owing to the fact that business is developing beyond present facilities, the Electric Storage Battery Company, Philadelphia, is expanding, and extensions are being built to its Crescentville plants. When these plants were erected it was expected that they would be more than sufficient to take care of all demands for a long time, but this year's business has surpassed all expectations and necessitated immediate expansion.

The company has purchased a site in Chicago and will erect a large warehouse, an addition to its present large distribution equipment, which already numbers about a score of depots in active operation. Directors will meet in New York this week to take action on preferred and common dividends.

Novel Method of Advertising Electric Washers in St. Louis

The Frank Adam Electric Company, St. Louis, employed during the week of Nov. 19 a novel method of advertising the new Western electric washer. During this week three luxurious parlor cars were leased from the United Railways Company and fitted up for demonstrating this new electric washer. From 9 o'clock in the morning until 4 in the afternoon every day in the week these parlor cars traveled back and forth over some particular car line, every car being assigned to a different route each day. Eighteen different car lines were covered during the week. A sign on the front of the car read: "Frank Adam Special—Women Ride Free—Hop in!—We'll Bring You Back."

An advertisement in the daily papers read as follows: "Get on and ride free; you won't be bothered to buy. This is Frank Adam's thirty-eighth anniversary — Western Electric's fifty-fourth. They want you to see the most wonderful washer ever made. Two stores aren't large enough to hold the crowds that want to see it. That's why special cars are bringing it right into your neighborhood."

Chicago Holds Second Radio Show

With more than 125 exhibitors displaying their latest radio equipment, the second annual Chicago Radio Show was held at the Coliseum Nov. 20 to 25. The difference in present radio equipment compared with that of two years ago was particularly noticeable in the improved physical appearance of the sets and the simplification of circuits.

On Thursday evening Dr. Lee De Forest gave an interesting lecture on his early research work in the development of the three-electrode tube. Another feature of the show was the drawing of prizes held in connection with the "listeners' program vote," which was held for the purpose of determining the class of music the public desires.

Eureka Company Occupies New District Offices in Boston

The Eureka Vacuum Cleaner Company has moved its New England headquarters office and service station from 12 West Street, Boston, to 577 Washington Street in the same city. Growth of business in the Northeast has necessitated occupying the entire third floor of the building, giving the company about three times its former space.

W. G. Keay, New England manager, says that the total sales of cleaners by his organization in New England during 1923 will reach 20,000, compared with 16,000 in 1922, and that for the country as a whole his company's unit sales will run about 75 per cent ahead of last year. The new offices are in the heart of the retail shopping district.

Western Electric Organization Changes in Expansion Program

Important organization changes announced by the Western Electric Company involve the appointment of three new assistant works managers and two superintendents in the manufacturing department. These changes are part of a program of expansion being carried out in the new Western Electric Works at Kearny, N. J., which in their ultimate development may duplicate the tremendous plant at Chicago.

C. L. Rice, formerly production superintendent of the Hawthorne works at Chicago, and S. S. Holmes, general superintendent of installation of the installation department, have been promoted to assistant works managers at Hawthorne. R. C. Dodd, at present operating superintendent of the Hawthorne works at Chicago, has been promoted to assistant works manager at the new Kearny works. This appointment is effective March 1, 1924.

Mr. Rice entered the company's service as an apprentice course student in the West Street shops, New York, in 1902. On the completion of his course in 1906 he was assigned to the engineering department, and a year later he entered the shop output department. In 1911 he was promoted to works manager of the London factory and three years later returned to America to take up duties as superintendent of the production branch at Hawthorne.

Mr. Holmes started with the Western Electric Company in 1900 as an apprentice course student at Chicago in the Clinton Street shops. He became successively assistant chief inspector and chief inspector of the New York shops, chief of the inspection organization at Hawthorne and assistant general superintendent of installation. Since 1922 he has been general superintendent of installation.

Mr. Dodd became secretary of the Nippon Electric Company at Tokio on completion of his student course. Four years later he returned to America as chief of the installation department, with headquarters at Hawthorne. In 1916 Mr. Dodd became chief of the operating branch.

J. J. McKenna, who was formerly assistant general purchasing agent at Hawthorne, succeeds Mr. Rice as superintendent of production, and W. H. Meese, supervisor of installation methods and results, succeeds Mr. Dodd as operating superintendent at Hawthorne.

Racine Manufacturing Company Enters Electrical Field

Through the installation of special equipment costing about $100,000 the Racine Manufacturing Company, Racine, Wis.—a branch of the McCord Manufacturing Company—is now in a position to enter into the manufacturing of switchboards and other electrical and telephone equipment for the Western Electric and American Telephone & Telegraph Company, from which companies it has received contracts for equipment which will keep the plant operating on a capacity basis for a year or two. Prior to its entry into the electric manufacturing field this company devoted all of its time and equipment to the making of automobile bodies. The company now employs 600 men and will increase this to about 900 when full operating capacity is reached.

The Blaw-Knox Company, Pittsburgh, manufacturer of steel transmission towers and poles, announces that Charles K. Wehn has been placed in charge of a special department devoted to Blaw-Knox standard steel buildings and structural steel in Illinois and adjoining states.

The Litlude Battery Company, Morgantown, W. Va., is planning for the erection of a new one-story plant at Connellsville, Pa., 38 ft. x 115 ft., for the manufacture of electric batteries and kindred products.

The P. A. Geier Company, Cleveland, will soon build an addition to its East 105th Street works, doubling the present floor space of both its plants. The extensions will include a four-story reinforced-concrete building, 68 ft. x 240 ft., a one-story wing, 56 ft. x 66 ft., and the addition of three stories to a one-story building. The additional space will be used for the manufacture of washing machines, vacuum cleaners and other electrical household appliances.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An exclusive agency is desired in Berne, Switzerland (No. 8,378), for accumulators and batteries.

Purchase is desired in Rouen, France (No. 8,353), for small engines, from 1½ hp. to 10 hp., for farms.

Purchase and agency is desired in Antwerp, Belgium (No. 8,379), for electric household appliances, such as vacuum cleaners and irons.

Purchase and agency is desired in Dublin, Ireland (No. 8,380), for electric household appliances, incandescent lamps, wire, switches, flashlights and batteries.

An agency is desired in Basel, Switzerland (No. 8,377), for electrolytic copper, in cakes, wire bars, round billets, ingots and ingot bars.

Purchase and agency is desired in Rangoon, India (No. 8,372), for torch and incandescent lamps.

TENDERS FOR ELECTRIC PLANT, WELLINGTON, NEW ZEALAND.—Tenders will be received by the secretary of the Public Works Tender Board, Wellington, New Zealand, until April 30, 1924, for power house and plant, section 2, Arapuni electric power scheme. For details see Searchlight Section.

TENDERS FOR SUBSTATION EQUIPMENT AND MOTOR-GENERATOR SETS, SYDNEY, AUSTRALIA.—Tenders will be received by the New South Wales Government Railways and Tramways Commissioners, Sydney, Australia, until Feb. 6 for equipment for substations. Tenders will also be received until Feb. 27 for motor-generator sets.

PROPOSED MUNICIPAL ELECTRIC PLANTS IN BRAZIL.—A number of municipalities in the State of Rio Grande do Sul, Brazil, according to *Commerce Reports*, contemplate the construction of municipal electric plants. Requests are frequently received from municipalities asking to be put in touch with American firms that would be willing to finance and install power plants or extensions to existing stations. The name of one municipality which has made a request as above stated, together with a list of firms and individuals of good reputation, recommended by Consul Bradley as prospective agents for American firms, may be obtained from the Electrical Equipment Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., or co-operative offices of the bureau, by referring to file No. 112,053.

New Apparatus and Publications

ELECTRICAL APPLIANCES.—Bulletin No. 17-23 distributed by Harvey Hubbell, Inc., Bridgeport, Conn., covers its new small attachment plug, composition convenience outlet and brass flush plate with self-closing spring door.

PLATE RHEOSTATS.—The Ward Leonard Electric Company, Mount Vernon, N. Y., has added new sizes to its line of "Vitrohm" (vitreous-enameled) variable rheostat plate. They are now made in sizes from 5½ in. square to 14 in. square and also include in the line a larger plate in standard size, 15 in. by 24 in. The round type of plates are made in sizes from 5-in. diameter to 19-in. diameter.

MOTOR-DRIVEN CHAIN HOIST.—Bulletin No. S-801 issued by the Motorbloc Corporation, Summerdale, Philadelphia, describes its "Motorbloc" motor-driven chain hoist.

INSULATING MATERIAL—"A Material of Endless Possibilities" is the title of a booklet issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., containing information about "Micarta" and the many uses to which it has been put and indicating the possibilities for other applications.

LIGHTING FIXTURES.—The Central Electric Company, 316-326 South Wells Street, Chicago, is distributing a catalog describing and illustrating the various types of its "Attalite" luminaire and its application in the illuminating field.

TRANSFORMER TESTING SET.—Bulletin No. 716 issued by the Leeds & Northrup Company, 4901 Stenton Avenue, Philadelphia, describes and illustrates the "L & N" potential transformer testing set.

RENEWABLE FUSES.—The Buffalo Fuse Corporation, Buffalo, is distributing a leaflet covering the "Pierce" renewable fuses.

CEILING BRACKETS.—The United States Hardware & Manufacturing Company, Pawtucket, R. I., is distributing four leaflets describing its ceiling, wall and insulator brackets.

New Incorporations

THE CHIMNEY ROCK MOUNTAIN, INC., Charlotte, N. C., has been incorporated with a capital stock of $12,000,000. Under the terms of its charter it is given authority to operate hydro-electric plants and various allied businesses, to develop real estate, etc. The incorporators are: M. O. Dickerson, Jr., E. O. Thomas, B. B Deggett, L. B. Morse and others.

THE SOUTHERN WYOMING ELECTRIC COMPANY, Rock Springs, Wyo., has been incorporated by Eugene McAuliffe E. S. Brooks, G. E. Bisbonnet, N. H. Loomis and Edwin Rich. The company is capitalized at $150,000 and proposes to build hydraulic works and transmission lines and will operate under franchises in various towns and cities in Sweetwater County.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

BINGHAM, ME.—The Central Maine Power Company is reported to be considering the construction of a hydro-electric plant on the Kennebec River with initial capacity of 60,000 hp.

BUCKSPORT, ME.—The Bangor Railway & Electric Company has been authorized to extend its electric service from Orrington to North Bucksport.

ENOSBURG, VT.—The Enosburg Falls Water Corporation contemplates the installation of electric pumping machinery in connection with waterworks extensions, to cost about $75,000. Lewis D. Thorpe, 200 Devonshire Street, Boston, is engineer.

NORTHAMPTON, MASS.—A new 13,000-volt transmission line is being erected by the Northampton Electric Lighting Company from Florence to Leeds to supply electricity to the Federal Psychopathic Hospital on Bear Hill. A substation will be erected at Leeds.

SOMERSET, MASS.—The Fall River Electric Light Company is reported to have purchased a site in South Somerset on which the proposed power plant of the Montaup Power Company will be located.

PAWTUCKET, R. I.—The Blackstone Valley Gas & Electric Company plans to erect a substation on Stiness Street, to cost about $55,000. Stone & Webster, Inc., 147 Milk Street, Boston, are engineers.

GEORGETOWN, CONN.—Arrangements have been made by the Gilbert & Bennett Company to purchase electricity from the Connecticut Light & Power Company, Waterbury, to be supplied by the Devon plant. The former company will discard its power plant.

Middle Atlantic States

BROOKLYN, N. Y.—Bids will be received by William H. Gompert, architect of the Board of Education, corner Flatbush Avenue Extension and Concord Street, until Dec. 14 for installing gas and electric fixtures in new Public School 100, on West Third Street, near Sheepshead Bay Road. Also for installing electric fixtures and fittings in new Public School 205, Twentieth Avenue and Sixty-seventh Street, and also installing electric fixtures and fittings in new Public School 210, Rochester Avenue and Park Place.

CORNING, N. Y.—The Corning Light & Power Company plans to erect a transmission line from Elmira to Corning with extensions to Riverside, South Corning, Erin, Gang Mills and Coopers, to cost about $50,000.

LONG ISLAND CITY, N. Y.—The New York & Queens Electric Light & Power Company has purchased the property of Remington Typewriter Company at Flushing, which it proposes to convert into a central storeyard and distributing station.

NEW YORK, N. Y.—The Long Island Railroad Company, Pennsylvania Terminal, has preliminary plans for the electrification of its lines in Queens Borough, to cost about $25,000,000.

NEW YORK, N. Y.—The Baltimore & Ohio Railroad Company, 2 Wall Street, has tentative plans for the electrification of its lines and terminals on Staten Island, to cost about $13,000,000.

NEW YORK, N. Y.—The New York Telephone Company is having plans prepared for the erection of a telephone exchange building at 204 Second Avenue, to cost about $750,000. It is also considering building an exchange on Sherman Avenue, to cost about $500,000.

NEW YORK, N. Y. — Bids will be received by William H. Gompert, architect, Board of Education, Flatbush Avenue Extension and Concord Street, Brooklyn, until Dec. 14 for installing gas and electric fixtures in addition to Public School 121, East 103d Street near Second Avenue, Borough of Manhattan.

OSWEGO, N. Y.—Bonds to the amount of $350,000 have been voted for a municipal electric light and power plant.

TUPPER LAKE, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Dec. 12 for the installation of an automatic telephone system at the United States Veterans' Hospital, Tupper Lake.

BRIDGETON, N. J.—The Illinois Glass Company, Alton, Ill., plans to install electric power equipment in connection with the rebuilding of its local plant, recently destroyed by fire with loss of about $250,000.

ALTOONA, PA.—The Penn Press Ice Cream Company, Front Street, plans to erect a new plant and power house at Beale Avenue and Twenty-eighth Street, to cost about $150,000.

CHESTER, PA.—The Delaware County Electric Company, owned by the Philadelphia Electric Company, is reported to be contemplating the construction of a large substation on Sixth Street between Welsh and Madison Streets.

PENNSBURG, PA.—The Pennsylvania Power & Light Company has applied for permission to acquire the properties of the Pennsburg Power & Light Company, the municipal power plant at Pennsburg, Redhill Electric Light, Heat & Power Company; Upper Hanover Power & Light Company, Palm Electric Light & Power Company and the municipal power plant at Greenville. The plants will be merged and additional transmission lines erected.

ANNAPOLIS, MD.—Bids will be taken at once by the navy supply officer, Naval Academy, for 1,000 screw-base lamps, 800 waterproof sockets and 250 receptacles. (Nav. req. 214.)

BALTIMORE, MD.—Electric power equipment will be installed in the plant to be erected at Mosher and Brice Streets by the Lafayette Mill & Lumber Company, Lafayette Avenue, to cost about $75,000.

CUMBERLAND, MD.—The construction of a new glass-manufacturing plant, including a power house, to cost about $100,000, is under consideration. W. R. E. King is interested.

ELKTON, MD.—The Eastern Power Company has acquired the properties of the Perryville Electric Company, Oxford (Pa.) Electric Company, Port Deposit Power Company, Rising Sun Electric Company, Havre de Grace Electric Light Company and the Gilpin Falls Power Company. The systems will be consolidated and transmission lines eected to connect the different plants. A contract has also been made with the Home Power Company for power supply.

INDIAN HEAD, MD.—Bids will be asked at once by the local navy supply officer for 87,000 ft. copper telephone wire. (Y. & D. req. 2.)

GLEN LYN, W. VA.—Plans are being prepared by the Appalachian Power Company, Bluefield, for a fourth addition to the Glen Jean hydro-electric station. Work is progressing on the third addition, which will increase the output to 60,000 kw. The fourth will increase the capacity to 80,000 kw.

MARTINSBURG, W. VA.—The Eastern Sewer Pipe & Brick Company plans to build a power house at its proposed local sewer-pipe, tile and brick plant, to cost about $250,000.

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, until Dec. 17 for 21,000 to 26,250 dry batteries (Proposal C. P. 16079-1 C. P.); also for 2,550 pairs of protector mountings, without fuses, and 15,000 fuses (Circular CP 16318-1).

WASHINGTON, D. C.—Plans are being prepared at the United States Engineer Office, Old Land Office Building, for a hydro-electric power plant in Maryland, to include reservoir, conduits and filtration plant, to cost about $5,000,000. Major N. C. Tyler is in charge.

North Central States

BELLEVUE, MICH.—The Alpha Portland Cement Company has contracted with the Consumers' Power Company for service at its local mills. Substation equipment will be installed.

L'ANSE, MICH. — The voters have approved the proposal to purchase an auxiliary light plant for the municipal lighting system, for which contract, it is understood, has been placed.

CLEVELAND, OHIO. — Plans involving an expenditure of about $1,750,000 for extensions and improvements to the municipal electric plant are under consideration by the City Council. Charles G. Beckwith is commissioner of the municipal plant.

NEW PHILADELPHIA, OHIO. — The Ohio Power Company plans to build a new substation near the city, to cost about $1,100,000, connecting the transmission system from the generating plant under construction at Philo to Canton. A transmission ssytem will be erected from New Comerstown to New Philadelphia.

OAK HARBOR, OHIO.—The Board of Public Affairs has authorized the replacement of the present wire with heavier wire in the municipal distributing system. The cost is estimated at about $5,000.

SANDUSKY, OHIO. — The Lake Shore Railway Company contemplates erecting a substation, to cost about $50,000.

LOUISVILLE, KY.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Dec. 26 for the installation of one electric passenger elevator, hoistway, etc., in the United States Marine Hospital at Louisville. For details see Searchlight Section.

VINCENNES, IND.—The Indiana Power Company has issued $500,000 in capital stock, part of the proceeds to be used for extensions.

CHICAGO, ILL.—Electric power equipment will be installed in the plant to be erected by the Continental Can Company, 61 Broadway, New York, at 4618 West Grand Avenue, Chicago, to cost about $500,000. Francisco & Jacobus, 511 Fifth Avenue, New York, are architects and engineers.

OLNEY, ILL.—The installation of electrically operated pumping machinery in the municipal waterworks, to cost about $75,000, is under consideration.

ROCKFORD, ILL.—The installation of new equipment is contemplated by the Free Sewing Machine Company, including a traveling crane, electric furnace, etc.

BELLEVILLE, WIS. — The Southern Counties Power Company has applied to the Railroad Commission for authority to issue $40,000 in capital stock to provide funds for extensions to its plant.

BELOIT, WIS.—The City Council is considering the installation of additional lamps throughout the city.

ELKHART LAKE, WIS. — The Badger Public Service Company contemplates extending its electric service to Calumet.

MILWAUKEE, WIS. — Plans are being prepared by Holabird & Roche, 104 South Michigan Avenue, Chicago, for the erection of a service building, power house, laundry, etc., for the Wisconsin Realty Company, 182 Third Street, to cost from $150,000 to $200,000.

NESHKORO, WIS.—C. G. Dahlke and F. L. Geise of Neshkoro, are reported to have started work on a hydro-electric project to cost about $50,000. Equipment, it is said, will be purchased about Jan. 1. The Jacobsen Engineering Company, Fawkes Building, Minneapolis, is in charge of construction.

FORT WING, WIS.—The Northern Wisconsin Hydro-Electric Company has applied for permission to issue $270,000 in capital stock and $60,000 in bonds, the proceeds to be used for the erection of a transmission line and distribution system in connection with its hydro-electric plant at Orienta Falls.

WHITEFISH BAY, WIS. — The Village Board contemplates the installation of an ornamental lighting system in the west end of the village.

ALEXANDRIA, MINN.—Bids will be received by H. S. Campbell, city clerk, until Dec. 10 for an ornamental lighting system on Sixth Avenue. The Charles L. Pillsbury Company, Capital Bank Building, St. Paul, is engineer.

PINE CITY, MINN.—The Eastern Minnesota Power Company plans to erect a transmission line to the Pokegama Lake section to connect with the Brook Park-Grasston transmission system.

SLAYTON, MINN.—The Northern States Power Company, Minneapolis, is planning to erect a transmission line from Slayton to Mountain Lake during 1924, where it will connect with a transmission line from Minneapolis.

ATALISSA, IOWA.—The Iowa Electric Company, Cedar Rapids, has applied to the Public Service Commission for permission to erect a 2,300-volt transmission line from West Liberty to Atalissa to supply electrical service at the latter place.

CLERMONT, IOWA.—The Northeastern Power Company, it is reported, is planning to build a new steam-driven electric plant at Clermont.

DENISON, IOWA. — Extensions to the municipal electric plant are under consideration.

OELWEIN, IOWA.—The Iowa Railway Light & Power Company, Cedar Rapids, is planning to erect a high-tension transmission line from Winthrop to Oelwein.

BOLIVAR, MO.—Bonds to the amount of $50,000 have been voted for extensions and improvements to the municipal electric plant.

BOONVILLE, MO.—The purchase of a 250,000-gal. motor-driven pump for the waterworks system is under consideration.

DESLOGE, MO.—The St. Louis (Mo.) Smelting & Refining Company plans to rebuild its crusher house, rolling plant, power house, conveyor house, etc., recently destroyed by fire. The loss is estimated at $200,000.

ST. LOUIS, MO.—The installation of an ornamental lighting system on the Delmar Boulevard is under consideration.

BUXTON, N. D.—The erection of a transmission line from Grand Forks, to supply electricity here is under consideration.

SIDNEY, NEB.—Extensions and improvements to the street-lighting system, including replacing the present four-lamp clusters with single lamps, are under consideration.

YORK, NEB.—The Nebraska Gas & Electric Company contemplates building a substation in York.

EMPORIA, KAN.—The Atchison, Topeka & Santa Fé Railway Company has tentative plans for the construction of a power plant at its proposed local shops, to cost about $300,000.

RUSSELL, KAN. — The installation of electrically operated pumps in connection with a proposed waterworks system, to cost about $90,000, is under consideration by the Council.

Southern States

CHIMNEY ROCK, N. C.—The Chimney Rock Mountain, Inc., is considering a power development to generate electricity for a proposed summer resort, to cost about $4,000,000.

WADEVILLE, N. C.—The installation of a municipal electric plant is reported to be under consideration by the town officials.

GREENVILLE, S. C.—Bids will be received at the office of the Supervising Architect, Treasury Department, Washington, D. C., until Dec. 18 for the installation of a full-magnet electric freight elevator for the United States post office and court house at Greenville. For details see Searchlight Section.

ATLANTA, GA.—The Georgia Railway & Power Company is disposing of a preferred stock issue of $1,400,000, part of the proceeds to be used for extensions and improvements.

LEESBURG, FLA. — The Florida China Clay Company plans to replace its steam-power plant with a 600-hp. electric power plant, to include two units of 300 hp. each.

FORT PAYNE, ALA.—Application has been filed by the Fort Payne Power Company with the Public Service Commission for permission to construct a hydro-electric plant at De Soto Falls on Little River.

HEFLIN, ALA.—Extensions and improvements are contemplated to the local electric plant, recently acquired by John W. Kitchen.

NASHVILLE, TENN.—Charles D. Jones & Company are considering tentative plans for rebuilding their power plant, recently damaged by fire, causing a loss of about $500,000.

UNION CITY, TENN. — Bonds to the amount of $125,000 have been voted for extensions to the municipal electric and water plant and sewerage system.

FAYETTEVILLE, ARK.—The Northwest Arkansas Utilities Corporation, recently formed with a capital of $500,000, plans to take over and consolidate the Fayetteville Gas & Electric Company, Springdale (Ark.) Gas & Electric Company, and the Rogers (Ark.) Light & Power Company. Extensions are planned, including transmission lines.

LOREAUVILLE, LA.—The Vida Sugar Refining Company is planning to rebuild its sugar refinery recently damaged by fire, with a loss of about $100,000. The power house was destroyed.

DEWEY, OKLA. — The Dewey Portland Cement Company is erecting an electric transmission line from Bartlesville to Dewey.

BRECKENRIDGE, TEX. — The Southwestern Gas, Light & Power Company, recently formed, with a capital of $700,000, plans to take over and consolidate the Olney (Tex.) Light & Power Company, Breckenridge Gas Company, Newcastle (Tex.) Light & Gas Company and the Graham (Tex.) Gas Company. Extensions are planned, including additional transmission lines. Headquarters will be established at Fort Worth.

EL PASO, TEX.—The El Paso Cotton Mills Company plans to build a 600-hp. power plant at its proposed mill, to cost about $1,000,000.

LAMESA, TEX.—The Texas Power & Light Company has acquired the system of the Lamesa Light & Ice Company. Extensions will be made in the power plant to double the present capacity. The ice-manufacturing plant will also be enlarged and additional machinery installed.

LUBBOCK, TEX.—Bonds to the amount of $75,000 have been voted, of which $50,000 will be used for extensions and improvements in the municipal electric plant and $25,000 for an ornamental street-lighting system in the business section.

Pacific and Mountain States

KEYPORT, WASH.—Bids will soon be asked by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for an addition to the operating building at the local radio station. (Specification 4926.)

LOWELL, WASH.—The Walton Lumber Company plans to build a power house at its proposed local veneer mill, to cost about $500,000.

SEATTLE, WASH. — The Washington Irrigation & Development Company, Henry Building, has applied for permission to construct a hydro-electric plant at Priest Rapids, Columbia River, with ultimate capacity of 350,000 hp., to cost about $32,000,000. The plans provide for a dam 2 miles long and 90 ft. high.

ASTORIA, ORE.—The Crown-Willamette Paper Company, Pittock Building, Portland, contemplates the construction of a power house at its proposed local pulp mill at the Youngs River Falls, to cost about $175,000.

MAUPIN, ORE. — Permission has been granted to J. H. and E. C. Woodcock to construct a hydro-electric plant at Dufur Springs.

BAKERSFIELD, CAL.—The Kern River Water Storage District plans to acquire existing canals and irrigation facilities and to construct a dam on the Kern River, install pumping plants and to build new canals, etc., at a cost of about $15,000,000.

COLUSA, CAL. — The purchase of the local system of the Pacific Gas & Electric Company to be owned and operated by municipality, is under consideration. If acquired, extensions and improvements will be made.

FORTUNA, CAL.—Steps have been taken by the Business Men's Club for the installation of a municipal electric fire-alarm system.

HAYWARD, CAL.—The National Ice & Cold Storage Company, Post Telegraph Building, San Francisco, plans to build an ice and cold-storage plant here, to cost about $75,000.

MERCED, CAL.—The San Joaquin Light & Power Corporation has applied for permission to construct a hydro-electric plant

on the Merced River, to cost about $1,100,000.

NATIONAL CITY, CAL. — Schiefer & Sons, Inc., San Diego, plans to build a power house at its proposed local furniture plant, to cost about $100,000.

REDDING, CAL. — The Pacific Gas & Electric Company contemplates the erection of a telephone line from Redding to the Vaca-Dixon substation, 88 miles, to cost about $100,000.

RIVERSIDE, CAL.—The Southern Sierras Power Company has acquired the properties of the Holton Power Company in the Imperial Valley district. The construction of a transmission line from El Centro west, about 100 miles, to cost $500,000, is under consideration.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company plans to erect a transmission line to Rincon, about 17 miles, to cost about $175,000.

SAN FRANCISCO, CAL. — The Pacific Gas & Electric Company plans to build an addition to its substation at Commercial and Montgomery Streets, to cost about $500,000.

SMARTSVILLE, CAL.—Plans are under consideration by the Excelsior Water & Power Company for the construction of a dam, 100 ft. to 166 ft. high, on Deer Creek, with penstock and power house.

YUBA CITY, CAL.—Plans are being considered for the installation of an electric fire-alarm system.

PHOENIX, ARIZ.—The Arizona Power Company has issued $400,000 in bonds, part of the proceeds of the sale to be used for extensions.

Canada

ST. STEPHEN, N. B.—The Hollingsworth & Whitney Company, 185 Devonshire Street, Boston, Mass., plans to build a power plant at its proposed paper pulp mill on the St. Croix River, to cost about $450,000.

WOODSTOCK, N. B.—The Carleton Electric Company, Ltd., recently incorporated with a capital stock of $99,000, plans to erect a transmission line to Woodstock, from a connection with the lines of the Maine & New Brunswick Electrical Power Company at Aroostook Falls. Edgar R. Teed, Woodstock, is one of the incorporators.

FORT WILLIAM, ONT.—Plans for linking up the Nipigon hydro-electric plant with the power lines of the Kaministiquia Pulp & Paper Company to secure additional energy for Fort William is under consideration by the Hydro-Electric Power Commission of Ontario.

LONDON, ONT.—A bylaw providing for an issue of $150,000 in debentures for the construction of a dam in the River Thames at Springbank by the Public Utilities Commission will be submitted to the ratepayers at the municipal election.

TORONTO, ONT.—The City Council has authorized an issue of $2,375,000 in debentures for the rehabilitation and equipment of the railway lines within the city limits formerly operated by the Toronto Suburban Railway Company by the Toronto Transportation Commission.

TORONTO, ONT.—The construction of a steam-driven power plant with a capacity of 100,000 hp. and ultimately 300,000 hp. in Toronto, to supplement the Hydro-Electric system, is under consideration by the Hydro-Electric Power Commission of Ontario. The cost is estimated at between $8,000,000 and $9,000,000.

BRYSON, QUE.—Arrangements are being made by the Ottawa River Power Company for a hydro-electric plant at Bryson under a 61-ft. head. The ultimate capacity of the plant will be from 60,000 hp. to 75,000 hp.

CALUMET, QUE.—Plans are being considered by the provincial government for the construction of a dam at Grand Calumet Falls on the Ottawa River to develop 50,000 hp., to cost between $3,000,000 and $4,000,000.

Miscellaneous

TAMPICO, MEX.—Work is under way on the electrification of the Mexican Railway between Orizana and Esperanza (48 miles), which it is expected will be placed in operation in March, 1924. Electricity will be supplied by the Puebla Light & Power Company from its plant at the Orizaba Falls. The entire system from Vera Cruz and Mexico City (650 km.), it is expected, will be electrified as soon as possible.

Electrical Patents

Announced by U. S. Patent Office

(Issued Nov. 20, 1923)

1,474,367. COMBINED RHEOSTAT AND CUT-OUT; J. E. Jenkins, Chicago, Ill. App. filed May 20, 1922. For electron tubes.

1,474,371. ENGINE STARTER; A. T. Kirk, Chicago, Ill. App. filed Jan. 3, 1922. Means for engaging motor pinions to flywheel.

1,474,382. APPARATUS FOR WIRELESS TELEGRAPHY AND TELEPHONY; H. J. Round, London, England. App. filed March 31, 1920. Auxiliary apparatus for vacuum tubes.

1,474,384. ELECTRIC HEATING UNIT; T. C. Russell, Chicago, Ill. App. filed June 17, 1922. For percolators, flatirons, waffle irons, etc.

1,474,408. DETECTING CIRCUIT; R. W. Deardorff, Brooklyn, N. Y. App. filed Nov. 16, 1920. Transmission system employing carrier current.

1,474,426. SECRET COMMUNICATION SYSTEM; H. A. Affel, Brooklyn, N. Y. App. filed July 19, 1922. For radio carrier telephone and telegraph systems.

1,474,430. TELEPHONE REPEATER; O. B. Blackwell, Garden City, N. Y. App. filed May 29, 1919. For phantom transmission systems.

1,474,434. BATTERY CONNECTOR; J. E. McKee, Connellsville, Pa. App. filed March 30, 1921. Test clip.

1,474,451. ELECTRIC CANDLE; T. Stückelberger, Montmirail, Switzerland. App. filed Dec. 16, 1922. Small flashlight.

1,474,460. ELECTROPLATING ANODE; E. M. Beck, Greensburg, Ind. App. filed July 5, 1922. Core for platinum electrodes.

1,474,483. ELECTRIC HEATING APPLIANCE; C. A. Laise, Weehawken, and A. J. Gallager, West Orange N. J. Small utensil for household use.

1,474,486. ELECTRICAL CONDENSER; B. MacPherson, Roxbury, Mass. App. filed June 3, 1919. Condenser adapted for high-potential service.

1,474,523. STORAGE-BATTERY-CELL TOP; A. O. Garrett, San Diego, and C. E. Funnell and W. L. Hoffman, Los Angeles, Cal. App. filed Oct. 27, 1920. Hard-rubber top.

1,474,524. OIL HEATER; C. J. Garrigan, Millvale, Pa. App. filed May 22, 1922. For preheating fuel oil before burning.

1,474,528. ELECTRICAL WATER HEATER; W. Hurst, Winnipeg, Manitoba, Canada. App. filed Dec. 23, 1919. For preventing water in automobile radiator from freezing.

1,474,562. COMBINED ELECTRIC COOKER AND WATER-HEATER APPARATUS; T. R. Stancombe, Bristol, England. App. filed Aug. 6, 1923.

1,474,588. THERMOSTATIC SWITCH FOR FLATIRONS; R. D. Hetrick, Indiana, Pa. App. filed March 11, 1921.

1,474,594. METHOD OF AND APPARATUS FOR OBTAINING ION CONCENTRATION EFFECTS; E. A. Keeler, Norristown, Pa. App. filed May 1, 1922. Electrolytic action.

1,474,597. INDUCTION COIL; A. A. Kent, Ardmore, Pa. App. filed June 25, 1921. For ignition of internal-combustion engines.

1,747,608. AUTOMATIC TELEPHONE SYSTEM; R. G. Richardson, Chicago, Ill. App. filed June 29, 1917. Improved circuits for individual line or trunk selecting switches.

1,474,624. MAGNETIC CONCENTRATOR; E. W. Davis, Minneapolis, Minn. App. filed Jan. 14, 1921. For use in making magnetic-iron assays.

1,474,638. ELECTRIC WATER HEATERS; A. Martin, Ogdensburg, N. Y. App. filed March 14, 1922. Electric arc used as heating medium.

1,474,648. AUTOMATIC TELEPHONE SYSTEM; A. B. Smith, Evanston, Ill. App. filed Oct. 1, 1920. Relates to secondary nonnumerical rotary switch.

1,474,693 and 1,474,694; OVERLOAD CIRCUIT BREAKER; F. Tobien, Essen, Germany. App. filed March 27, 1922. For protecting motors connected selectively in series or parallel.

1,474,723. ELECTRIC HEATING DEVICE; M. M. Levinson, Pasadena, Cal. App. filed April 12, 1921. Heating unit for soldering iron.

1,474,726. METHOD OF AND ARRANGEMENT FOR RECEIVING ELECTRICAL OSCILLATIONS; A. Meissner, Berlin, Germany. App. filed Aug. 8, 1922. Heterodyne reception of undamped oscillations.

1,474,735. ELECTRIC LAMP; A. J. Sanders, Spokane, Wash. App. filed July 22, 1922. Pedestal of floor lamp composed of mirrors.

1,474,736. INSULATOR; F. Schaub, Jersey City, N. J. App. filed May 21, 1920. Knob for open wiring.

1,474,739. STOP SIGNAL AND REAR LIGHT; S. J. Thomas, Youngstown, Ohio. App. filed April 17, 1922.

1,474,740. TAIL LIGHT AND STOP SIGNAL; S. J. Thomas, Youngstown, Ohio. App. filed Oct. 26, 1922.

1,474,757. WATER-COOLED TRANSFORMER; R. V. Bingay, Pittsburgh, Pa. App. filed Nov. 27, 1920. Automatic control of water circulation.

1,474,758. PLUG RECEPTACLE; C. H. Bissell, Syracuse, N. Y. App. filed June 21, 1918. For installations in which wires are inclosed in conduits.

1,474,761. SECONDARY CELL AND SEPARATOR PLATE FOR USE THEREIN; T. A. Campbell, New York, N. Y. App. filed Nov. 30, 1920.

1,474,763. ELECTRICAL APPARATUS; D. Conlan, Jr., Brooklyn, N. Y. App. filed Dec. 24, 1920. Special attachment plug.

1,474,777. ELECTRIC WATER HEATER; L. Jarkovsky, Vienna, Austria. App. filed Oct. 25, 1921. Tubes form short-circuited secondary of transformer.

1,474,780. IGNITION SYSTEM; L. S. Keilholtz, Dayton, Ohio. App. filed Aug. 10, 1918.

1,474,824. WELDING MACHINE; C. L. Hoff and G. G. Naugle, York, Pa. App. filed March 1, 1921. For welding chains.

1,474,825. PORTABLE COOKING OUTFIT; G. Howard, Michigan City, Ind. App. filed Nov. 27, 1922. Electric grill.

1,474,829. COVER FOR CONTAINING CELLS OF ELECTRIC BATTERIES; L. Lyndon, New York, N. Y. App. filed Dec. 2, 1919. Water-tight cover but with suitable ventilating means.

1,474,830. POROUS, ACID-RESISTING DIAPHRAGM; L. Lyndon, New York, N. Y. App. filed March 14, 1921. For separators in batteries, diaphragms for filtration or for electrolytic processes.

1,474,833. PRESSING DEVICE; O. Hauptman, New York, N. Y. App. filed Aug. 23, 1922. Trousers press electrically heated.

1,474,887. ELECTRIC HEATING ELEMENT; R. G. Bridges, Toronto, Ontario, Canada. App. filed March 27, 1922. Heating element covered with asbestos cord.

1,474,909. VAPORIZING ATTACHMENT FOR INTERNAL-COMBUSTION ENGINES; J. Medveczky, New York, N. Y. App. filed Sept. 25, 1918. Electric type.

1,474,936. DIRECTIONAL SIGNAL; W. B. Lawrence, Suffolk, Va. App. filed March 8, 1920. Rear signal for automobiles.

1,474,942. ELECTRIC-VEHICLE CONTROL; K. Probst, Toledo, Ohio. App. filed Feb. 13, 1922. Two normal speeds possible by means of battery connections.

1,474,944. DISTANT INDICATING MEANS; F. L. ReQua, Milwaukee, Wis. App. filed June 30, 1919. Method of controlling searchlights.

1,474,955. ELECTRIC RECORDING METER; H. W. Carpenter, Norwich, Conn. App. filed Nov. 4, 1922. Demand recording watthour meter.

1,474,960. ELECTROMAGNETIC BRAKE; B. E. Fernow, Jr., Milwaukee, Wis. App. filed July 2, 1921. Means for equalizing the releasing movements of brakeshoes.

1,474,965. ELECTRICITY METERING SYSTEM; J. Harris, Lafayette, Ind. App. filed Jan. 26, 1920. Meter for recording power used above specified minimum only.

1,474,972. TERMINAL FOR ELECTRIC CONDUCTORS; J. A. Kulier, Brooklyn, N. Y. App. filed Nov. 17, 1920. Wire clamped to terminal.

1,474,973. AMPLIFYING RECEIVER; H. G. Leach and J. S. Leach, Brooklyn, N. Y. App. filed April 26, 1922. Loud speaker for radio circuits.

1,474,975. ELECTRICAL COUPLING; F. P Mansbendel, Brooklyn, N. Y. App. filed June 13, 1917. Connector for telephone receivers.

1,474,976. SYSTEM OF CONTROL FOR SYNCHRONOUS MOTORS DRIVING THROUGH CLUTCHES; R. I. Maujer, Cincinnati, Ohio. App. filed July 8, 1922.

1,474,981. ADJUSTABLE CONSTRUCTION; M. Ozlek, Philadelphia, Pa. App. filed March 15, 1921. Standard for floor lamp.

1,474,991. CIRCUIT CONTROLLER; C. W. Yerger, Boston, Mass. App. filed April 9, 1921. Method of obtaining smooth acceleration when starting motors.

1,475,003. WATER HEATER AND CONTROL SWITCH THEREFOR; M. D. Cominguez, New Orleans, La. App. filed May 20, 1922. Portable type.

1,475,027. DETECTOR FOR WIRELESS SIGNALS; E. F. Randall, Medford, Mass. App. filed June 7, 1922. Crystal type.

1,475,088. FIREPLACE HEATER; L. M. Specht and J. A. Shimek, Chicago, Ill. App. filed March 31, 1921. Combined with unit for furnishing hot water.